APPLIED HYDRAULICS

SEPTEMBER 1955

THE MAGAZINE OF
FLUID POWER

INCLUDING AIR CONTROLS
AND AIR CIRCUIT DESIGNS
• ELECTRICAL CONTROLS •

Are Your Machine Tools Up-to-Date? . . . page 70

There's a Punched Tape in Your Future . . . page 72

Sequential Control from a Cam Shaft . . . page 74

Machine Tool Tracers . . . page 86

What To Do About Jumpy Machine Feeds . . . page 98

Aviation Section . . . page 102

25th ANNIVERSARY

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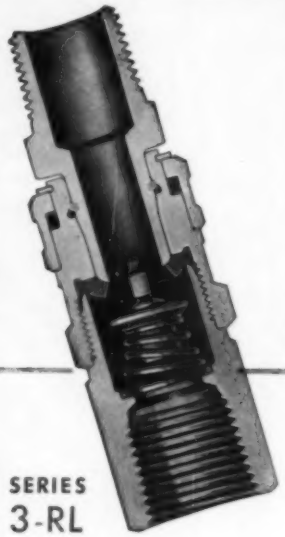

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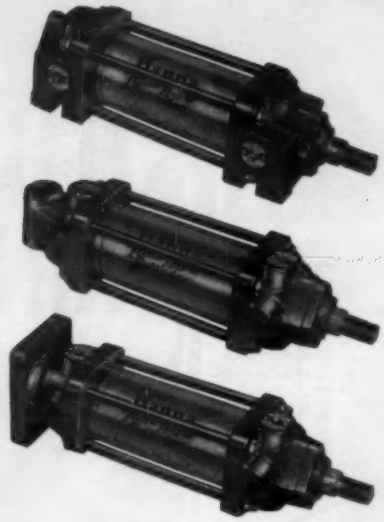

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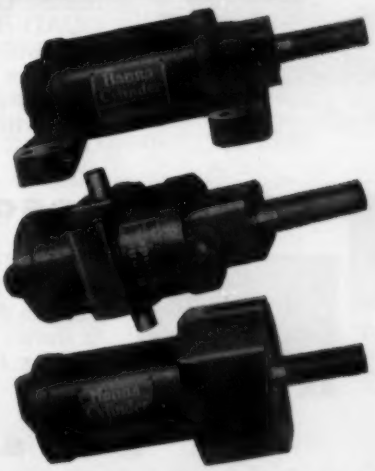

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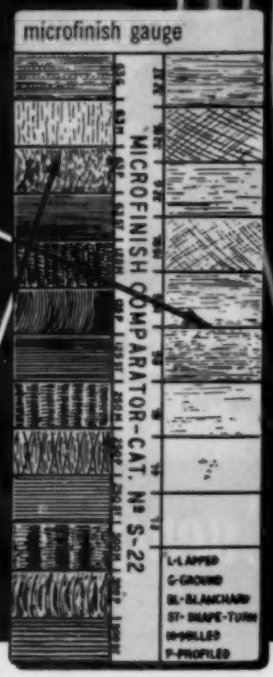

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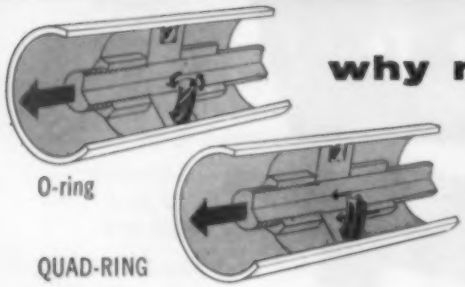

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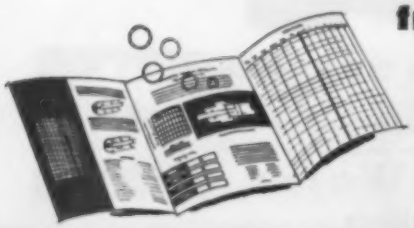

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DEPARTMENTS

FLUID POWER LINES 8

NEW PRODUCTS 16

BRIEFS 22

LETTERS TO THE EDITOR 56

USEFUL LITERATURE 64

IDEAS FROM A SALES ENGINEER 121

POST SCRIPTS OF INDUSTRY 148

MARKET PLACE 153

FEATURE ARTICLES

EDITORIAL—25 YEARS OLD 67

FLUID POWERED MACHINE TOOLS 69

ARE YOUR MACHINE TOOLS UP-TO-DATE? 70

THERE'S A PUNCHED TAPE IN YOUR FUTURE 72

SEQUENTIAL CONTROL FROM A CAM SHAFT 74
By Walter Schroeder

STANDARD COMPONENTS AND MACHINE TOOLS 77

DUAL PRESSURE RELIEF VALVE IMPROVES CHUCKING MACHINE CIRCUIT 80
By Robert C. Ebersold

MODERN MULTI-SPINDLE DRILLING AND TAPPING 82

MACHINE TOOL TRACER CONTROL 86
By Allan E. Morris

SYNCHRONIZING MOTOR SPEEDS WITH FIXED DISPLACEMENT PUMPS 92
By J. R. Fawcett

SHOULD THERE BE NON-ADJUSTABLE PRESSURE CONTROLS ON MACHINE TOOLS? 96

WHAT TO DO ABOUT JUMPY MACHINE FEEDS 98

CONSTRUCTION IDEAS FOR A HYDROSTATIC TEST FIXTURE 124

PROBLEM CLINIC—TWO LIMIT SWITCH ACTUATED TIMERS 146
By M. G. Saake

AVIATION SECTION

SUPPLY CORRECT OPERATING SPECS 102

SERVO VALVES CONTROL JET ENGINE TEST 108

TRENDS IN AIRCRAFT HYDRAULICS 114
By W. E. Eldred

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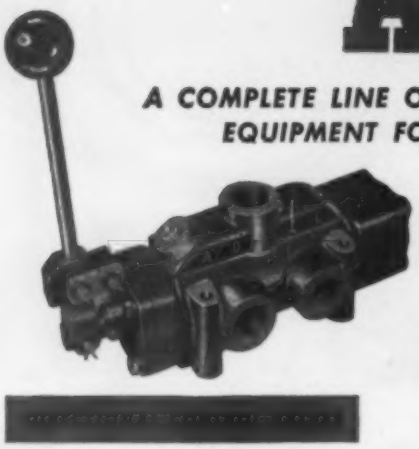

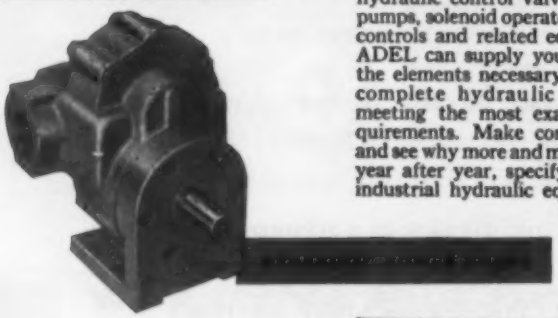

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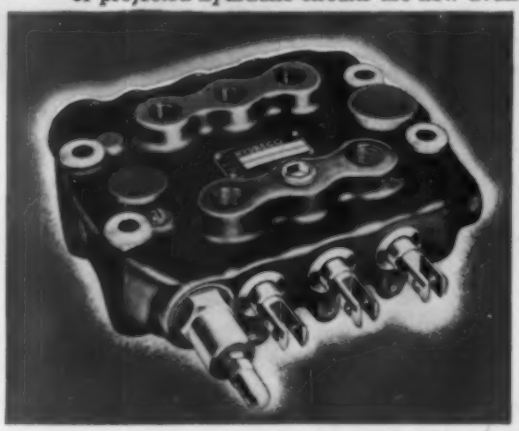

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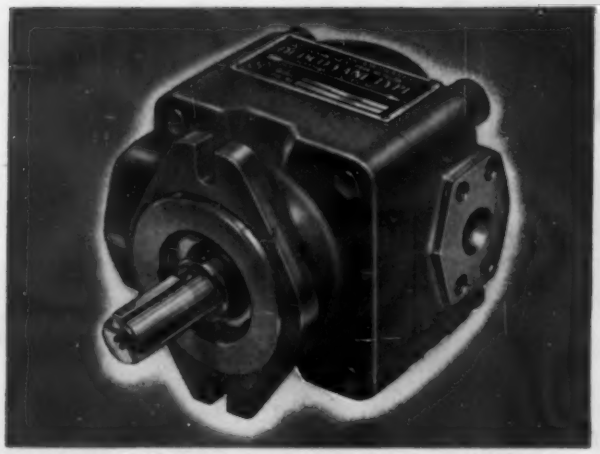

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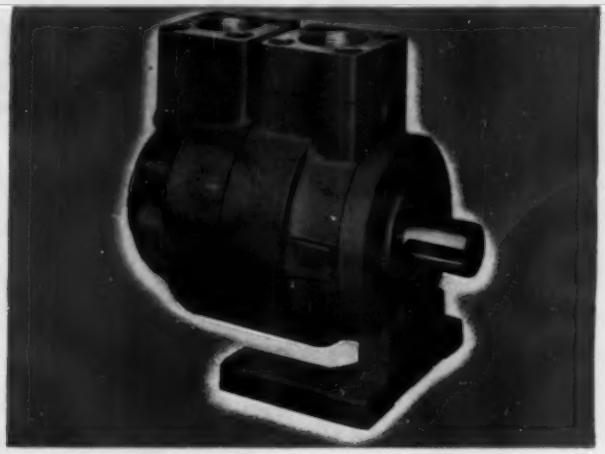

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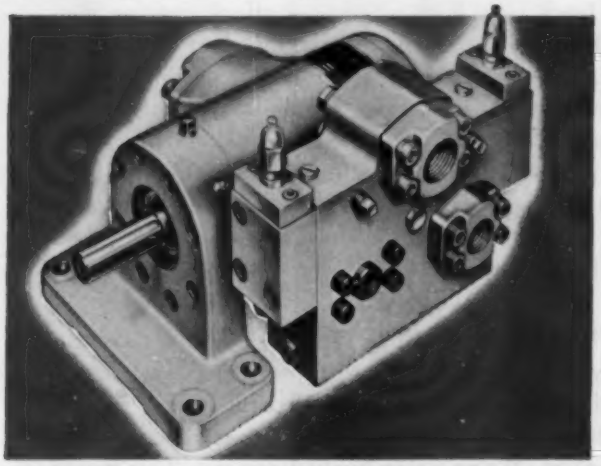

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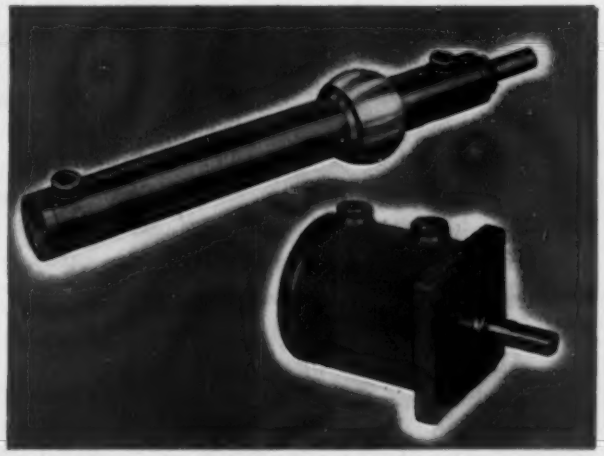

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Fluid Power Lines

about Applied Hydraulics

MACHINE TOOLS... Use of pneumatics and hydraulics on machine tools is the theme of this issue. We've chosen the theme for very obvious reasons. By now, if your work involves any type of metal working machine, you have been flooded with information about the three shows being held in Chicago between the 6th and 16th of this month.

Maybe we impress easily, but the enormity of this three ring affair (we hesitate to use that obvious word) has our feet hurting already. In our Briefs columns there is a review of many of the machines which will be set up at one of the three shows. This represents only a fraction of the huge effort being made. These shows offer an unprecedented opportunity to see, learn about and BUY equipment being made in all parts of the country.

Take an extra pair of roller skates.

THE PRESENT WITH CAM CONTROLS... Walter Schroeder's article tells about control of hydraulic machine tool functions by use of a cam shaft. This technique which has been in use for many years, is presently widely used and we are sure will continue to be applied for some time even with the advent of punch tapes.

A FUTURE WITH PUNCHED TAPES... Control of machine tool feeds from a punched tape offers amazing possibilities. Hydraulic controls are arranged to respond to an electrical signal resulting from a device which reads the holes punched in the tape. All this is explained in an article about Minneapolis-Honeywell's work in this field.

Like any code, there is something mysterious and frustrating about punched tapes or cards. Maybe along with courses in blueprint reading, a course in reading punched cards can be developed.

IS OUR PERSONALITY SHOWING?... We always get trapped by tests in the Sunday supplements which prove conclusively that we are a good husband, good parent, good neighbor, good gardener, good driver, good golfer, good adfinatum. We've never flunked one yet. This month we have tried our hand at creating a test by which you can learn if you've been properly treating your fluid powered machines. Turn to page 70. Allow 5 for every "yes" answer, subtract 10 for every "no" answer and divide by 4 for every indifferent answer. Any total less than 50 means you've got oil on the shop floor.

REVIEW OF TRACER SYSTEMS... No coverage of fluid power circuits on machine tools would be complete without an article detailing air and hydraulic tracer systems. Tracers or duplicating systems which cause tool motion to respond to movement of a finger or stylus on a template have been in use for many years. They have been modified and improved to give us greater accuracy and reliability. Our article, compiled by associate editor, Allan Morris, details the design, characteristics and application of four tracer controls.

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Fluid Power Lines

continued

SHOP FOLKLORE . . . We couldn't resist using an old idea which crafty fellows like H. Allan Smith apply when they write books. At the top of each chapter some invaluable bit of nonsense is written to introduce the reader to the subject. We've done the same thing above the article on multi-spindle drilling and tapping. Only we're not sure it's entirely nonsense.

SYNCHRONIZING SPEEDS . . . Another question which we often hear is: "How do we keep cylinder or motor speeds in step?" one reader wrote: "On paper, a series circuit looks like it will work. How come it doesn't" APPLIED HYDRAULICS has published a number of articles on this subject. There's no pat answer for all situations. Our British friend, John Fawcett details the operation of a fluid motor control circuit which produces almost perfect synchronization. Inaccuracy is so small that it is incapable of detection by ordinary speed measuring methods.

1955 PRIZE WINNERS . . . In October, winners of the APPLIED HYDRAULICS Prize Paper Contest will be announced. Winners of the three top prizes, $500, $300 and $200, will be presented their checks at the morning session of the NCIH October 27th. Entries, submitted from the United States and abroad, were judged by David Hutchinson, Sundstrand Machine Tool Co., William E. Adamek, Fisher Body Division, General Motors Corporation and Joseph F. Ziskal, International Harvester Company. The three top papers will be published in October. All papers judged as meriting publication will appear in APPLIED HYDRAULICS during next year.

11th NCIH . . . there's only one annual technical meeting devoted entirely to Fluid Power. That's the National Conference on Industrial Hydraulics. This year the Conference is being held Thursday and Friday, October 27 and 28, at the La Salle Hotel in Chicago. If you are involved in the design, production or maintenance of fluid powered equipment this conference is for you. Hotel reservations should be made now. For Conference reservations write to C. A. Arents, NCIH Secretary, Illinois Institute of Technology, Technology Center, Chicago 16, Illinois.

In October, APPLIED HYDRAULICS will publish the complete Conference program along with abstracts of the papers. The October issue is your guide to the Conference.

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But even at 1200° F. Pydraul didn't burn.

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Whatever the temperature conditions and viscosity requirements of your hydraulic equipment, one of the specially tailored Pydrauls will keep it operating smoothly and efficiently with all the SAFETY possible.

Can you honestly afford *not* to use it?

Use Pydraul F-9, Pydraul 150, or Pydraul 600 in your hydraulic equipment. For FREE copy of informative "Pydraul F-9" booklet, or data on Pydraul 150 and Pydraul 600, write: Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478-W-6, St. Louis 1, Mo.

LISTED UNDER UNDERWRITERS' LABORATORIES, INC. REEXAMINATION SERVICE — UL

PYDRAUL F-9—FIRST AND ONLY HYDRAULIC FLUID LISTED BY UNDERWRITERS' LAB

On May 31, 1955, Pydraul F-9 became the first fire-resistant hydraulic fluid listed by Underwriters' Laboratories. From the Laboratories' Service Card: "The fire hazard of (Pydraul) is rated 2 to 3 in accordance with Underwriters' Laboratories, Inc.'s Standard of Classification in which Ether rates 100, Gasoline rates 90-100, Alcohol(ethyl) rates 60-70, Kerosene (100°F. flash) rates 30-40 and Paraffin oil rates 10-20." See Underwriters' Laboratories, Inc.'s guide no. 540 18, File MH6049.

Pydraul: Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS AND PLASTICS

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

Let IPC take a look at your drafting board through a seal designed to meet your requirements.

Planning to manufacture new machinery? You can eliminate mechanical sealing headaches by asking IPC to design your oil seals and packings.

Dependable, trouble-free oil seals and packings are a direct result of good planning . . . and IPC design engineers have analyzed and developed cup, flange, U, V packings and oil seals for all kinds of industrial applications. Special synthetic or leather models, bonded case oil seals, O-rings, etc. will be drafted for *your specific problem.*

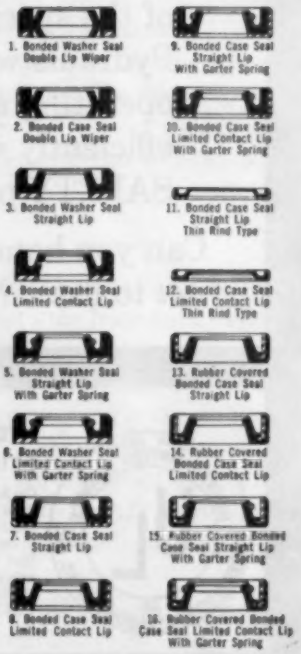
For the best material . . . the most effective design . . . *Write IPC — today,* while it's on your mind.

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

Branch Offices: Chicago, Dallas, Detroit, Kansas City, New York, Philadelphia, San Francisco, St. Louis.

BONDED BY IPC


1. Bonded Washer Seal Double Lip Wiper
2. Bonded Case Seal Double Lip Wiper
3. Bonded Washer Seal Straight Lip
4. Bonded Washer Seal Limited Contact Lip
5. Bonded Washer Seal Straight Lip With Garter Spring
6. Bonded Washer Seal Limited Contact Lip With Garter Spring
7. Bonded Case Seal Straight Lip
8. Bonded Case Seal Limited Contact Lip
9. Bonded Case Seal Straight Lip With Garter Spring
10. Bonded Case Seal Limited Contact Lip With Garter Spring
11. Bonded Case Seal Straight Lip Thin Rind Type
12. Bonded Case Seal Limited Contact Lip Thin Rind Type
13. Rubber Covered Bonded Case Seal Straight Lip
14. Rubber Covered Bonded Case Seal Limited Contact Lip
15. Rubber Covered Bonded Case Seal Straight Lip With Garter Spring
16. Rubber Covered Bonded Case Seal Limited Contact Lip With Garter Spring

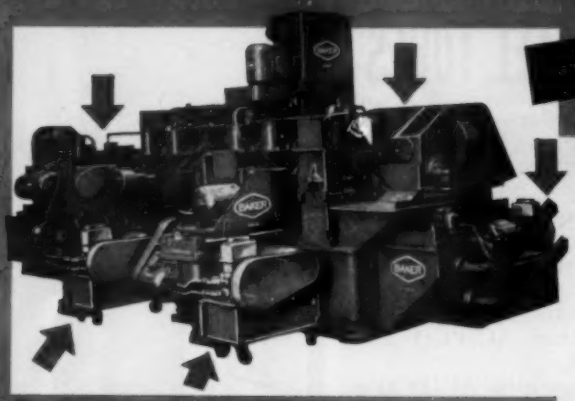
P5

Circle 63 on Reader Service Card

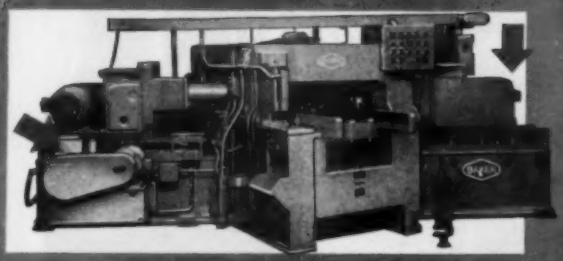
Circle 94 on Reader Service Card

OILGEAR "JK" FLUID POWER FEED PUMPS

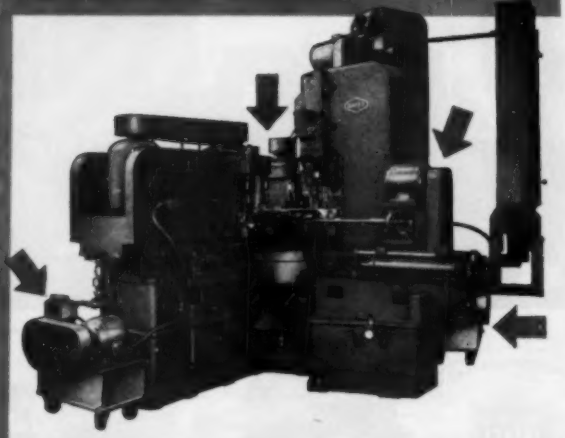
AS APPLIED TO BAKER BROTHERS MACHINES



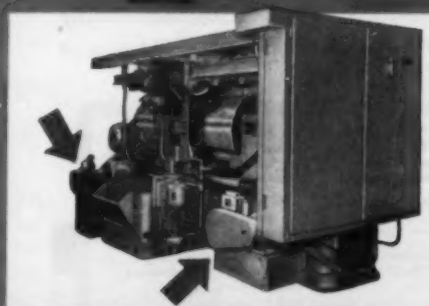
Five Oilgear "JK" Feed Pumps on Baker's Multiple Station Automatic Transfer Type Machine.



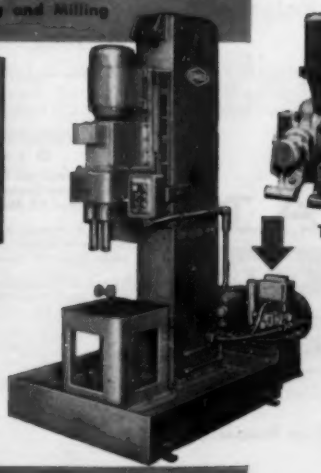
Two Oilgear "JK" Feed Pumps on Baker's Four-Station Automatic Transfer Type Machine.



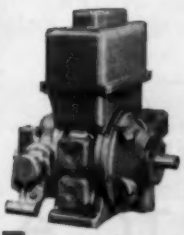
Four Oilgear "JK" Feed Pumps on Baker's Multiple Head Drilling, Boring, Reaming and Milling Machine.



Two Oilgear "JK" Feed Pumps on Baker's Double End Drilling, Boring and Reaming Machine.



Oilgear "JK" Feed Pump on Baker's Double Spindle Vertical Drilling, Boring and Reaming Machine.



Type "JK" Pump Built in four sizes.

HOW CAN YOU USE THESE SIMPLE, VERSATILE, EASILY APPLIED, PROFITABLE UNITS?

Baker Brothers, Inc., pioneers in machine building, users of Oilgear Feed Pumps since 1925, employ Oilgear "JK" Fluid Power Variable Delivery Feed Pumps on a host of machines including the headline-making 100-foot-long transfer machine and their own commercially available portable hydraulic power unit which you can see in photos Nos. 1 and 3 on this page.

The Oilgear "JK" Feed Pump offers many advantages, not the least of which are easy applicability and accessibility. There's no need in many cases for machine redesign and engineering. And this unit does so much to speed cycle time—traverse speed for example can be 265 times feed rate—that production rises dramatically and costs subside. Both coarse and fine feed rates can be varied infinitely so you at once discover the best rates for your work—and the automatic built-in compensator holds the selected fine feed *unvaryingly*. All functions are controlled automatically, semi-automatically or manually.

Evidence of Oilgear "JK" dependability is growing. In one large automotive plant, now 75% changed over to Oilgear, hydraulic maintenance staff was cut from 6 men to one man per shift. In another great automotive plant, the records show Oilgear is found to give the finest service of all.

There's much more to tell especially about two new units added to the "JK" line. Why don't you send for free literature that gives all the facts and figures. So you won't forget, send for it now.

THE OILGEAR COMPANY
1564 W. PIERCE STREET
MILWAUKEE 4, WIS.

OILGEAR
Fluid Power

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

The World's Largest Metal Baling Press Reduces Automobiles To Compact Bundles . . . Costs Are Reduced By

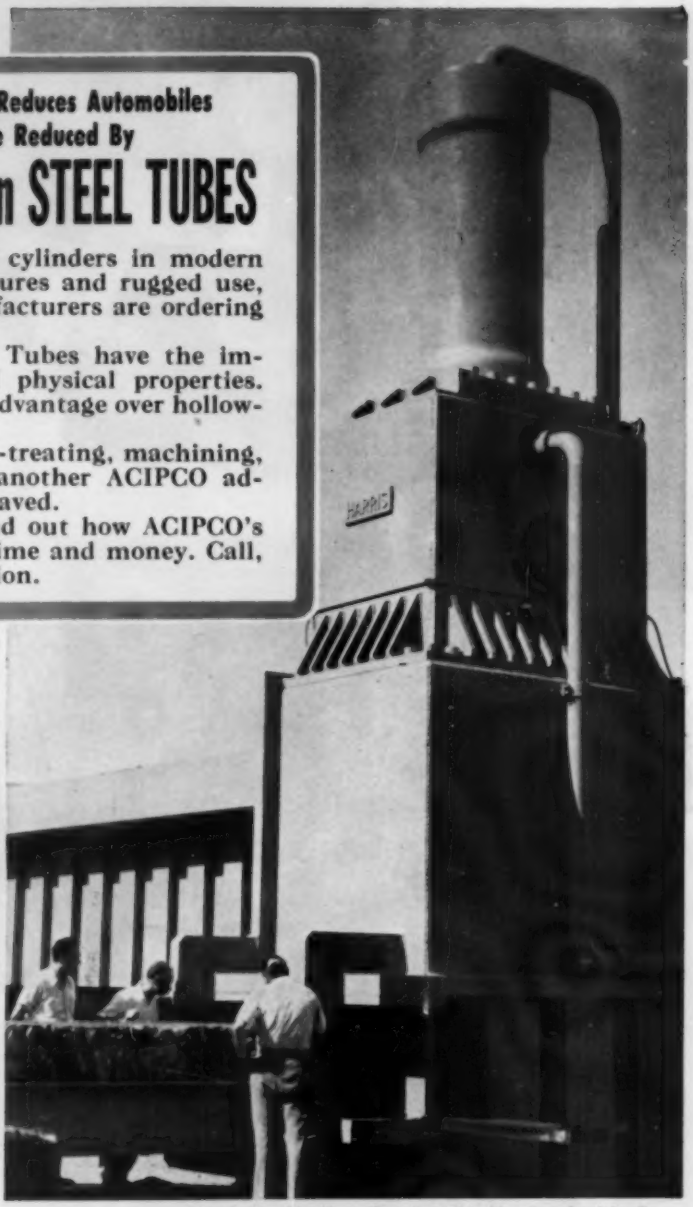
ACIPCO'S Centrifugally Spun STEEL TUBES

Because the precision honed walls of cylinders in modern presses must withstand extreme pressures and rugged use, more and more hydraulic press manufacturers are ordering ACIPCO Steel Tubes.

Centrifugally spun, ACIPCO Steel Tubes have the important advantage of non-directional physical properties. Large sizes also provide a decisive cost advantage over hollow-bored forgings.

Complete facilities for casting, heat-treating, machining, and honing—all under one roof—are another ACIPCO advantage. This means time and money saved.

Check your tubular steel costs. Find out how ACIPCO's *complete* facilities can help you save time and money. Call, write or wire ACIPCO for full information.

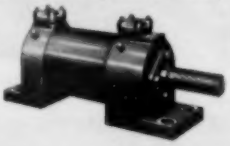


This metal baling press, the world's largest, exerts a force of 1018 tons in compressing a passenger car to a 2' x 2' x 5' bale. The tube for the gatherer cylinder of this press — 21" OD, 254¾" long, of 1035/1045 steel — was supplied finish machined by ACIPCO.

Manufactured by Harris Foundry & Machine Co., Cordele, Ga.

This view shows a Fulmer vertical honing machine in operation at ACIPCO. Capable of honing steel tubes 18' long, under 15" ID; 12' long, over 15" ID; and up to 29" ID, it is only one of ACIPCO'S complete machine shop facilities.

50th ANNIVERSARY
ACIPCO
1905 1955



ACIPCO produces a wide range of tubular steel sizes — up to 16' lengths (or welded into longer lengths), with OD from 2.25" to 50" and wall thicknesses from .25" to 4". Centrifugally spun tubes can be supplied in all alloy grades, including heat and corrosion-resistant stainless steel, as well as plain carbon grades. Special analyses are also available. ACIPCO centrifugally spun tubes can be furnished rough as cast, finish-machined, or honed.

ACIPCO centrifugally spun tubes are successfully used in the manufacture of many types and sizes of hydraulic cylinders.

DISTRIBUTORS

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226 Binney Street
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Lyman Tube & Bearings, Ltd.
920 Ste. Sophie Lane
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Peter A. Frasse and Co., Inc.
17 Grand Street
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J. M. Tull Metal & Supply Co.
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AMERICAN
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SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

MODERN INDUSTRY MOVES WITH HYDRAULIC POWER

delivered through

Eastman

HYDRAULIC HOSE ASSEMBLIES

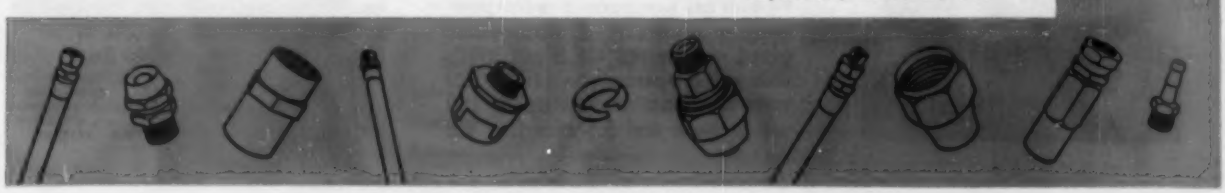
EASTMAN — *first in the field* of Hydraulic Hose Assemblies—has had the privilege of *pioneering* in many original applications of hydraulic power — on equipment made by many of America's leading manufacturers — as shown in action in the industries, above.

Modern industry not only moves *hydraulically*, but with increased efficiency and economy—with improved production and performance . . . the kind of performance that improves your competitive position in your field.

If you have a power transmission problem, consult with Eastman Engineers. For improved performance due to many original exclusive Eastman designs . . . for quality of material and workmanship—always specify Eastman Hydraulic Hose Assemblies.

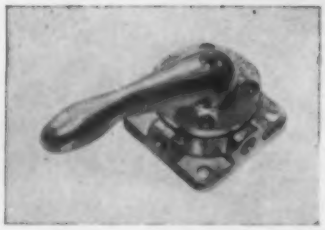
Eastman
first in the field
MANUFACTURING COMPANY
Dept. AH-9, Manitowoc, Wis.

FREE
WRITE for free Catalog 101 on Eastman Hose Assemblies.



New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.



AIR VALVE
. . . with rubber rotor

Designation: Model 3010

Design: Hand-operated, 3-position valve contains a rubber rotor bonded to the shaft. Instead of holes passing over ports as in most valves, the rubber rotor passes over smooth, rounded surfaces for a superior seal and longer valve life with no metal-to-metal contact. The valve is a cadmium-plated die casting and permits variable throttling with air pressures up to 150 psi. It is available in ¼ and ⅜-inch sizes and is built to operate for an unlimited number of cycles.

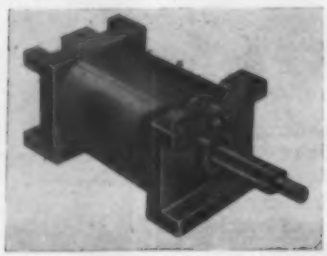
Mechanical Air Controls, Inc.
Detroit, Michigan
Circle 176 on Reader Service Card

TUBE BENDING TOOL
. . . bends stainless steel

Designation: Tork-grip

Features: Manual tool for non-slip tube bending may be held in a vise or permanently mounted on a work bench. Bender has a unique clamping arrangement which grips the tube firmly, permitting the bending of stainless steel tubing without slipping and resultant flattening. The unit has a close bending feature which consists of a straight-threaded bolt which mates with the nut and sleeve of a flare-type tube fitting, or nut and ferrule of a flareless-type fitting, to hold the tube so it can be bent immediately adjacent to the fitting.

Parker Appliance Co.
Cleveland, Ohio
Circle 177 on Reader Service Card



CYLINDER
. . . has elliptical piston rod

Features: Because of unique shape, piston rod cannot rotate. This eliminates the need for external guide bars or ways and reduces fixtures set-up time. Cylinder is designed with a spring return. Single-action, push-type cylinder is used for clamping, ejecting, stamping, staking, locating, and various other jobs. Both heads permit either flush or foot mounting to a horizontal or vertical plane.

Design: Cylinder is cast of high tensile Meehanite. The inside walls are bored and roller burnished. All wear parts are non-corrosive. Cylinder walls and pistons are hard-chrome plated, and guide bushings are made of oil-impregnated porous bronze. Units range from 5 to 8 inches in length and from 3 to 5⅜ inches in width and height.

Alkon Products Corp.
Hawthorne, New Jersey
Circle 178 on Reader Service Card

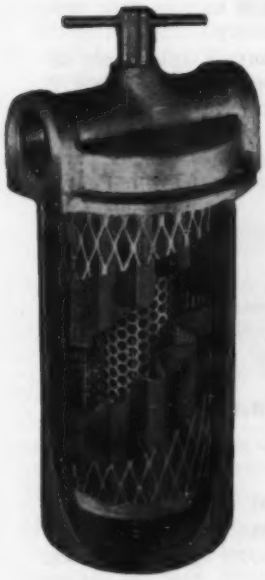
PORTABLE AIR COMPRESSOR
. . . is completely self-contained

Designation: Model 100

Features: Compressor is for powering pneumatic devices where piped compressed air is not available and is operated on 110 or 220 volts a-c. Unit delivers up to 100 psi pressure and 3.5 cfm free air. No tank or safety valve is required. Sealed ball bearings are used throughout, with no lubrication needed. Unit is complete with built-in intake filter, and is powered by 1/3-hp. motor equipped with overload protector and cord. Overall length is 13 inches; height is 10 inches. The unit weighs 40 lbs.

Modernair Corp.
San Leandro, Calif.
Circle 179 on Reader Service Card

SUMP TYPE
(cutaway)



LINE TYPE
(cutaway)

Here's What Users Have to Say About
MARVEL Synclinal FILTERS

U. S. STEEL CO., Irvin Works Three-Stand Cold Reduction Mill—

"Marvel Synclinal Filters are a part of the mill's main hydraulic system which operates Coil Cradle as well as other hydraulic machines".

JONES & LAUGHLIN STEEL CORP., Aliquippa Works—

"Marvel Synclinal Filters proved their effectiveness when one of the motors on the hydrostatic pipe testers broke down. A brass fitting was chewed up and jagged pieces of brass were carried into the oil stream. Any small piece of brass could also have caused a great deal of damage to the expensive equipment. However, when the unit was inspected, it was found that all metal particles had been filtered out by the Marvel Synclinal Filters and no damage had been done to the equipment nor was there any loss in operating time. Two filters are installed on each circuit so that one can serve as a by-pass while the other is being cleaned. Although it takes only about fifteen minutes to clean the monel filter insert, even this short interruption in production could be costly in an operation of this size".

P. R. MALLORY PLASTICS, INC. Supt. of Maintenance Leo Paszkiet reports—

"We have one injection molding press here that was giving me a lot of trouble. In order to maintain our 24-hour-a-day schedule, I had to stop it every two or three weeks to service the filters. It was a troublesome, time consuming job but it had to be done. Even then, the machine never seemed to reach the productive capacity I knew it was capable of. Well, I had enough of that so I pulled out the original 3 filters and replaced them with three 50 G.P.M. Sump type, Marvel Synclinal Filters. That was over 10 months ago. During all this time the machine was operating faster and smoother than it ever had before. There was no more slow down of production due to pressure loss, vibration, pump starvation, etc. On the basis of these results, we are installing Marvels on every hydraulic machine in our plant, except of course, those on which Marvel Synclinal Filters were installed as standard equipment by the manufacturer".

Many others reporting similar results are now specifying MARVEL SYNCLINAL FILTERS on all new hydraulic equipment—and Standardizing with MARVEL SYNCLINAL FILTERS on all existing equipment.

For Dependable Protection on All Hydraulic and Other Low Pressure Circulating Systems— Investigate MARVEL SYNCLINAL FILTERS

They Meet J. I. C. Standards

FILTERS FOR ALL TYPES OF FIRE-RESISTANT FLUIDS

Marvel's most recent development is a filter for the efficient filtration of all types of fire-resistant fluids.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced, synclinal design.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

See Our Exhibit
at the
PRODUCTION ENGINEERING SHOW
Booth #809
Navy Pier—Chicago, Ill.
SEPTEMBER 6-16, incl.

See
Marvel Synclinal Filters
in ACTION!

See Why
OVER 600
Original Equipment
Manufacturers
are installing them
as Standard Equipment!

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer Immediate Delivery!

Catalogs containing complete data available on request

MARVEL ENGINEERING CO.
625 W. JACKSON BLVD., CHICAGO 6, ILL.
PHONE: FRANKLIN 2-4431 & FRANKLIN 2-3530

Without obligation, please send me complete data on Marvel Synclinal Filters as indicated:

Catalog No. 106 for Hydraulic Oils, Coolants, Lubricants
Catalog No. 300 for Water
Data on filters for fire-resistant hydraulic fluids

AH-9

Name _____ Title _____

Company _____

Address _____

City _____ State _____

HAVING HOSE CRAMPS ?

MAYSON HOSE SWIVELS

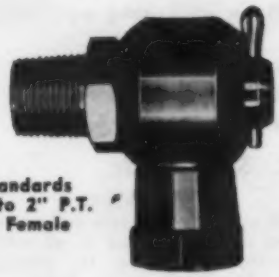
Take the kinks out! . . . and prolong hose life remarkably

Hoses installed five years ago with Mayson Swivels are still going strong, and so are the swivels! Swinging and twisting every ten seconds under 1000 pounds Oil pressure these hoses formerly lasted only two months.

In recent tests Mayson Swivels ran 2,000,000 revolutions at 1500 psi and 150 rpm before showing slow leakage.

Mayson Hose Swivels are used on machine tools, lift trucks, road machinery, hose reels and wherever hydraulics moves things.

Write for illustrated catalogue and Data.



J.I.C. Standards
Sizes ¼" to 2" P.T.
Male or Female

MAYSON MFG. CO.

4332 HORATIO STREET • DETROIT 10, MICH.

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MASSACHUSETTS—Hope Rubber Co., Fitchburg
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MISSOURI—Zopf Engineering Co., 214 E. 39th St., Kansas City 11

Circle 83 on Reader Service Card

New Products / continued

AIRCRAFT PUMPS . . . for 10,000 rpm

Designation: 1700 Series
Features: Pumps are direct driven and operate efficiently at speeds up to 10,000 rpm. Because of the high speed, they can be lighter and more compact than conventional aircraft

pumps. No gear train or gear-head motor is necessary.

Specifications: Displacement of smallest pump in series is .00419 cu. in. Displacement of largest pump is .02514 cu. in. Smallest pump weighs 1 lb. 12 oz. and pumps 55 gph at 65 psi. Pumps have an all aluminum housing, steel gears and shafts, synthetic rubber seals, bronze or carbon bearings.

Eastern Industries
Hamden, Conn.
Circle 180 on Reader Service Card

PILOT-OPERATED VALVE . . . with adjustable throttling

Designation: Type 10
Applications: Valve is recommended for water hydraulic presses,

as an unloading valve on extrusion presses, and as a back pressure control.

Design: Valve features easy conversion from a pressure reducing and regulating valve to a back pressure control valve by simply switch-

ing control piping. Dial-type range selector permits selection of throttling range necessary to give the most stable and sensitive control for the particular process application. Packless design results in low friction and high sensitivity. A Y-type strainer protects the pilot valve. The diaphragm assembly of the pilot valve can be easily changed for other pressure ranges.

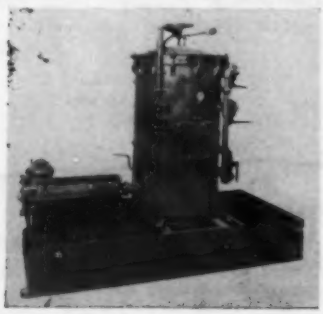
Specifications: Valve is available in iron, bronze, or steel; with bronze or stainless steel trim, and monel trim on the pilot valve. Sizes are from 2 to 12 inches with flanged ends, and from 2 to 3 inches with screwed ends.

A. W. Cash Co.
Decatur, Illinois
Circle 181 on Reader Service Card

OIL FILTER

. . . is self cleaning

Design: Filter uses diatomaceous earth with tubular filter elements. Screen elements are pre-coated with earth forming a filter cake to filter the fluid. Earth does not affect ad-



ditives present in most oils and processing fluids. Capacities range to 175 gpm.

Features: Cleaning is automatic and is accomplished in one to three minutes by back washing. Liquid is forced back through the tubular filter elements from the inside. The earth cake is knocked off and allowed to settle to the cone of the filter. Agitation in the cone prevents packing of the sludge.

Industrial Filtration Co.
Lebanon, Indiana
Circle 182 on Reader Service Card

TEMPERATURE PROBE

. . . senses oil temperature

Designation: Series 8000

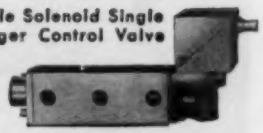
Features: To use the probe it is not necessary to drain the system, break lines, or add fittings. The split-cylinder probe is placed around the hydraulic line at whatever point

SELECT Quick-As-Wink®
AIR AND HYDRAULIC
CONTROL VALVES

DESIGNED AND BUILT TO ASSURE

Double Solenoid "O-Type" Control Valve

Single Solenoid Single Plunger Control Valve



Cam Operated "O-Type" Valve

Pilot Cylinder Operated Two Position Hydraulic Valve

efficient and dependable operation of your machines and machinery

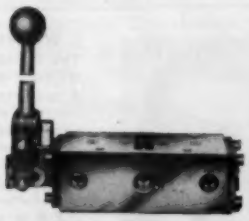
Can you afford to gamble with less?

• Why build — or buy — expensive machines and then restrict their output and risk breakdowns and production tie-ups because of inferior control valves?

Positive and fast acting Quick-As-Wink valves meet the most exacting requirements. They deliver dependable precision performance month after month and year after year. Machine operators, foremen, superintendents *and machine builder trouble shooters* will tell you that there is nothing better than a Quick-As-Wink valve. REMEMBER,— your efforts to increase production and cut costs can only be as successful as the air and hydraulic valves that control the operations. Don't gamble. Play safe. Specify Quick-As-Wink valves. Get full details. Write for Bulletin No. 531, *Today!*

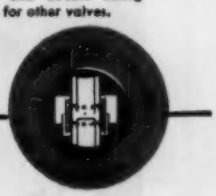
Ask us also about . . .

FOOT OPERATED SLIDING SLEEVE VALVE ⅜" to 1" sizes. Single pedal spring return and two pedal designs. Operator has both hands free to handle the work.



LEVER OPERATED SINGLE PLUNGER VALVE ⅜" to 1½" sizes. Widely used for controlling single and double acting cylinders and as pilots for other valves.

Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves



Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated
Mfd. by C. B. HUNT & SON, INC., 1999 East Pershing St., Salem, Ohio

A special report on

PROGRESS AT H-P-M

To Our Customers and Friends

1. H-P-M is now pledged to a series of broad, new policy decisions designed to strengthen our sales, service and manufacturing program. The growing demand for hydraulic equipment increases our responsibilities to the industry.
2. H-P-M will carry out this program as an independent company.
3. Significant developments are in the making for the months ahead. They will be announced within the next few months.
4. Key executives have been selected to play important roles in this new program. Their combined experience with H-P-M in the hydraulic field will accelerate the fulfillment of our plans and strengthen our position.

WILLIAM H. BENNETT
Vice President in Charge of Sales
A well-known H-P-M personality and graduate of University of Cincinnati, has served H-P-M as engineer, Sales Engineer, Director of Engineering, Sales Manager and now Vice President in Charge of Sales. Extensive experience in all phases of hydraulic design and application. Professional Engineer.

GLEN R. PITTMAN
Sales Manager, Hydraulic Power Division
Has successfully served in engineering capacities with H-P-M since 1938. Left the company briefly for another position and returns to head up Power Division sales of hydraulic pumps, cylinders, valves and power systems.

J. W. ARNOLD
Vice President in Charge of Manufacturing
A graduate of General Motors Institute with successful manufacturing and engineering experience in companies such as Cadillac, Ford, Clark Equipment Co., United Stove, and Erie Engine and Manufacturing Co. He brings to H-P-M a wealth of manufacturing managerial talent.

WILLIAM N. WOODWARD
Secretary-Treasurer
A graduate of Ohio State, has served the company since 1946 in the accounting department, as controller and assistant secretary. His promotion to Secretary-Treasurer is an important step in H-P-M's new program.

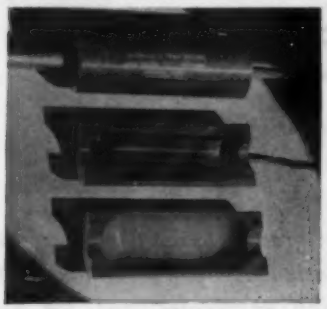
ROBERT J. LINDSEY
Director of Engineering
Another experienced H-P-M engineer promoted up through the ranks from engineer to Director of Engineering. Served as Chief Engineer of Elmes Engineering Division, American Steel Foundries. He returns to H-P-M now as Director of Engineering.

THE HYDRAULIC PRESS MANUFACTURING CO.
Mount Gilead, Ohio
U. S. A.
1084 MARION RD.

HPM

APPLIED HYDRAULICS

the temperature is to be measured. The unit thermally isolates that section of the line. Internally a spring-loaded saddle bears against the line wall. This saddle contains the ex-



tremely temperature-sensitive, high-resistance element. The probe is a resistance element wound at 20,000 ohms, so that high outputs can be obtained for relatively small changes in temperature when the unit is used in a bridge circuit. The probes are made in all sizes to fit hydraulic lines of all diameters. They can be used to measure temperatures in the range of —100 F to 500 F.

Arnoux Corp.
Los Angeles, Calif.
Circle 183 on Reader Service Card

AIR VALVE
. . . uses shear-seal principle

Designation: Model 2801

Design: Valve is designed for air pressures to 250 psi making available an air pressure valve designed according to the shear-seal princi-

ple. Unit incorporates features for easier mounting and plumbing. Any port may be used as the pressure port, and the valve body may be rotated in 90-degree intervals for the most convenient piping. A sturdy mounting bracket is furnished with the valve.

Sizes: Valves are available in ¼ and ⅜-inch ports.

Barksdale Valves
Los Angeles, Calif.
Circle 184 on Reader Service Card

For more NEW PRODUCT reviews turn to page 128

R/M VEE-FLEX®

AMERICA'S MOST COPIED PACKING

- **For steam rods, hot oil pumps, etc.**
- **For hydraulic rams, outside packed plunger pumps, accumulator rams, elevator rams, oil or water service.**
- **For food handling equipment.**

The completely homogeneous construction of R/M Vee-Flex—its deep, thorough compound penetration—enables it to take higher pressures without extruding than any other packing made. And its design makes it self-sealing, self-adjusting. The surface of each R/M Vee-Flex Ring is convexly curved where it touches the next ring. When the hydraulic pressure stroke occurs, this design produces an automatic seal laterally against the stuffing box wall and longitudinally against the next ring. For complete data, including a table of sizes, write for R/M Vee-Flex Bulletin.

RM **PACKINGS**
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N.J.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

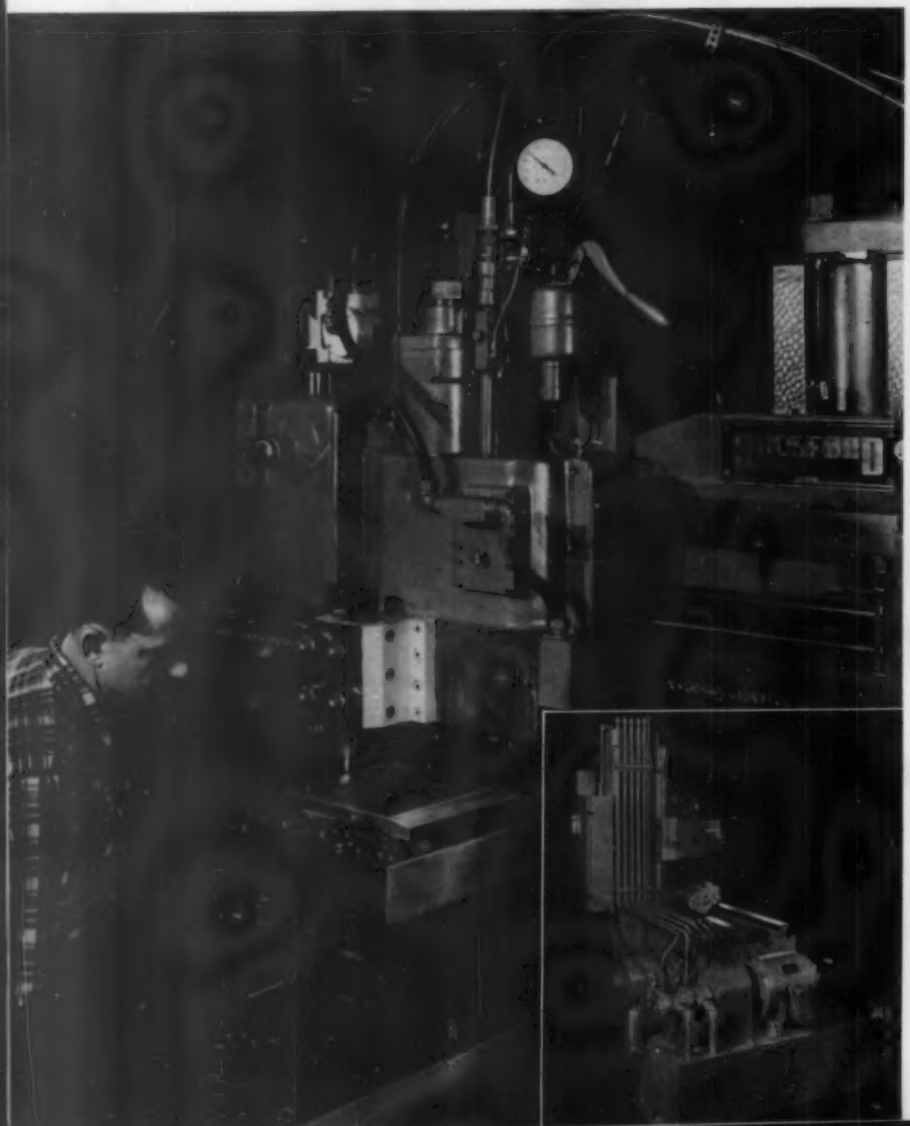
Circle 106 on Reader Service Card

BRIEFS about fluid power

Here, briefly presented, are some of the presses, shapers, lathes, transfer machines, grinders and other equipment, which will be seen at this year's National Machine Tool Show—September 6-17, International Amphitheatre, Chicago.

Technological developments in the use of fluid power have greatly assisted the progress of machine tool design since the last Show in '47.

Automatic machinery, designed for high speed and economical production, are including, in increasing numbers, air and hydraulic controls for accurate operation.



«« Hydraulic power is used in some way on all machines to be exhibited by Rockford Machine Tool Company, Rockford.

The completely new Openside Shaper with Duplicator has hydraulic feed and hydraulic duplicating attachment. Illustration shows a workpiece being machined with the hydraulic duplicating attachment and the separate hydraulic pumping unit (inset) used for its operation.

An Openside Planer and a Shaper-Planer which incorporate the new triple circuit design will also be displayed. This circuit provides infinite speeds from 10 to 300 fpm stepped through three distinct force ranges, and gives control of range and cutting speed selection.

Other equipment to be seen include a Special Hydraulic Shaper equipped with hydraulic drive, hydraulic feeds, and hydraulic tool lifter; a Hydraulic Slotter; and a Tracer Lathe with hydraulic tracer attachment.

«« Designed for modern high speed production milling, Giddings & Lewis, Fond du Lac, has built this new 10 inch Quill Planer-Miller. It weighs 200,000 pounds. Almost completely absent are manual controls,

Continued on page 25

Speed Control...

Our optional "Speed Control" feature is an addition to our complete line of pilot operated control valves

SELF CLEANING
No small orifice to clog

SINGLE UNIT
No additional piping required

SIMPLE TO ADJUST
From minute to maximum pipe area

Valvair

BOOTH 835
PRODUCTION ENGINEERING SHOW
CHICAGO, ILL.

Representatives in Baltimore • Birmingham • Boston • Buffalo • Charleston, W. Va. • Chicago • Cleveland • Cranford, N. J. • Dayton • Denver Detroit • Eureka, Calif. • Houston • Kansas City, Mo. • Logansport, Ind. • Louisville • Minneapolis • S. Pasadena • Philadelphia • Pittsburgh

Moderate Prices AND Quality Construction make WEBSTER

YOUR BEST BUY in Gear-Type Hydraulic Pumps

You pay no premium for quality construction features in any of WEBSTER's Positive Displacement Gear-Type Hydraulic pumps. In fact, you may be pleasantly surprised by the cost savings realized with these WEBSTER units.

For WEBSTER pumps save you money through moderate initial prices and lower installation costs resulting from WEBSTER's compact, flexible designs. And your customers get lower service costs because of the extra ruggedness and dependability provided by premium construction features like these:

- **Heavy-duty needle bearings withstand overloads. Anti-friction bearings throughout assure high mechanical efficiency.**
- **Temperature and oil resistant synthetic lip seal.**
- **Smooth running helical gears of alloy steel are precision made and properly hardened for quiet operation, long life.**
- **Double-row ball bearings absorb compound driving thrusts.**
- **Standard external seal drain permits use in either rotation. Internal drain can be furnished if desired.**
- **Pump cover is available with either end or side ports.**

And the WEBSTER line is complete—can meet the widest possible range of requirements. It includes over 100 different models ranging in capacities from 1/5 to 30 GPM, for pressures up to 1500 psi, speeds to 3600 RPM.

***FREE 12-PAGE CATALOG** contains complete information on WEBSTER'S complete line of over 100 different positive displacement gear-type pumps and fluid motors. Write for your free copy today.....*

OIL HYDRAULICS DIVISION

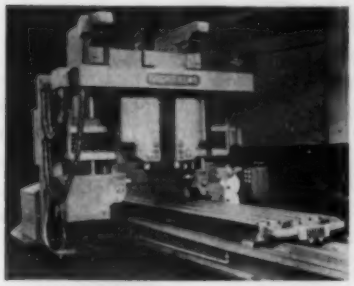
WEBSTER ELECTRIC

RACINE WISCONSIN

MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY

BRIEFS / continued

except for five pushbuttons on each head plus a single fingertip operated feed selector dial. The machine uses a "feed reel" system which encloses all hydraulic, electrical and coolant facilities, thus eliminating the usual



accumulation of various hoses, cables and wires around the headstocks. A new hydraulic counterbalance system plays an important part in the flatness accuracy in milling with the rail heads and reduces to a minimum the amount of wear possible between the rail and the headstock saddle. It also reduces the amount of power necessary to feed the heads and rail. All clamping on the machine is hydraulically operated.

«« Gardner Machine Company, Beloit, will show their new Double Disc Grinder in which parts are pneumatically transferred from the roll-chute to an 18-station rotary carrier.

The machine features automatic loading and unloading, rotary work carrier and automatic size control.

The company will also display a Double Spindle Grinder for grinding diecast aluminum torque converter housings. The housing is manually

Continued on page 26

New... FreeFlow GASKETS
made of TEFLON*

JOHN CRANE

"JOHN CRANE" FreeFlow Construction
Gasket flush with pipe I.D.—allows completely unrestricted flow.
No air pocket—insert flush with I.D. of envelope. No danger of rupture due to expansion of entrapped air at high temperatures.
AIR
Ordinary "Wishbone" Construction
Envelope extends beyond I. D. of pipe, causing flow restriction and turbulence.
Expansion of entrapped air at high temperatures presents danger of gasket rupture.

FOR EVERY CORROSIVE SERVICE

"John Crane's" FreeFlow construction and chemically inert Teflon have been combined as *the* answer for gaskets in hydraulic service. This new construction assures a flush fitting with the I.D. of the pipe and the inner wall of the Teflon envelope, not possible with the ordinary "wishbone" type gasket. (See drawing above).

This means elimination of:

1. Flow restriction and turbulence in the line.
2. Danger of rupture at high temperature due to entrapped air between gasket insert and Teflon envelope.

"John Crane" Teflon FreeFlow gaskets can be used in the transmission of all hydraulic or lubricating fluids, including the newly developed synthetics. They are unaffected by extreme temperatures from −100° to +482°F., depending on the insert material. Available in all shapes and sizes for a wide variety of service requirements.

Request full information on "John Crane" FreeFlow gaskets for your particular requirement. Ask for our informative booklet, *The Best in Teflon*, for other important technical and application data. Crane Packing Company, 1805 Cuyler Avenue, Chicago 13, Illinois. *In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.*

DEPEND ON "JOHN CRANE" TEFLON PRODUCTS

*DuPont trademark

JOHN CRANE CRANE PACKING COMPANY

Now...a "Sprague-Quality" HYDRAULIC TEST STAND at a new low cost

SPRAGUE
ENGINEERING CORPORATION
For operational and proof testing of hydraulic components and systems at pressures up to 3,000 psi and flows up to 6 gpm. Unit is completely self-contained in a heavy gage, all-steel welded cabinet and is fully equipped with all necessary instrumentation and controls. Measures 48" long by 39" wide by 64" high.

● Everyone who must test hydraulic components and systems to rigid standards will welcome the new Model S-1000. A small but complete test stand, it retains the same quality construction and materials of larger Sprague machines costing many thousands more. Unit is complete and ready for immediate service. *Flow control valve, flowmeter and oil cooling circuit included as standard equipment.*

Features:

- Controls out in front, easy to reach. Work does not get in the way.
- "Toe-under" front base panel for greater comfort, less scuffing.
- 15 gal. reservoir capacity with filter element.
- Constant flow piston type pump.
- For easy access, pressure outlets are located at forward part of tray.
- Pressure outlets point in, away from the operator.

Small manufacturers and overhaul stations will find that this one stand meets all their requirements. Large operators will order several units to keep multiple production lines moving. Write today for complete information and name of nearest representative.

SPRAGUE
Engineering Corporation
1144 West 135th St., Gardena, California

BRIEFS continued

loaded into a hydraulic retractable rotating fixture. Rotation of the part and hydraulic head feed begin, when the swinging arm of fixture moves into grinding position. Head movement for size control is accomplished by remote hydraulic controls at the operating station.

«« A closed circuit, low pressure hydraulic system operates this horizontal reciprocating Table Type Surface Grinder. Covel Manufacturing Company, Benton Harbor, maker of this equipment, utilized hydraulic

power to reciprocate the table longitudinally at speeds from 10 to 90 feet per minute. The table is moved transversely and automatically from .010 to .100 inch at each reversal of the table. Pump, motor and tank slide out from base of machine for easy maintenance.

«« Air operated clutch and brake mechanisms are incorporated in Turret Punch Presses developed by Wiedeman Machine Company, Philadelphia. The press illustrated punches 80-120 holes per minute in printed wiring boards. Holes are located to a color coded template. Operation of the air operated mechanism is simple. When the press operator depresses stylus tip into template hole, a limit switch is tripped, energizing two solenoids. One solenoid transfers brake connection from pressure to exhaust, disengaging crankshaft and brake,

Continued on page 28

Circle 120 on Reader Service Card
Circle 122 on Reader Service Card

STANOIL
INDUSTRIAL OIL

does heavy chores for
Light Metals Corporation

Tool Room Superintendent Max Chase (left) and Production Engineer Peter Van Dyke (right) with Standard lubrication specialist R. T. Cleland inspect frame of extruded aluminum. Bob Cleland, a graduate of Michigan State with a B.S. in Mechanical Engineering and of Standard's Sales Engineering School, has the background to provide customers with competent technical service on their lubrication problems. This training and experience, customers have found, pay off for them.

Light Metals Corporation uses this 1,250 ton Hydropress for extrusion of aluminum shapes for aircraft, automotive and major appliance industries. Press operates at 2,840 psi in the hydraulic system. Hydraulic medium is STANOIL.

Three years ago Light Metals Corporation, Grand Rapids, put their 1,250 ton Hydropress into operation. The initial fill for the hydraulic system was STANOIL Industrial Oil. The press has operated continuously since its start up. There is no evidence of deposits or varnish anywhere in the hydraulic system. Light Metals Corporation looks forward to many more years of such trouble-free operation.

Why was STANOIL ordered by Light Metals for their Hydropress? The answer is found in the service STANOIL has given in other equipment. Back in 1948 when a Watson-Stillman extrusion press went into operation for Light Metals, STANOIL was chosen as the hydraulic oil. As with the Hydropress, STANOIL has a perfect performance record. The Watson-Stillman press has operated seven years without shutdown because of hydraulic fluid failure.

This kind of service from a hydraulic oil means Light Metals Corporation can turn out extruded aluminum shapes for the aircraft, automotive and major appliance industries with high performance and low maintenance factors that mean bigger profits. Reason enough for relying on STANOIL.

STANOIL Industrial Oil can perform for you just as it is doing for Light Metals Corporation. In the Midwest a lubrication specialist from your nearby Standard Oil office will explain how. Call him. Or contact Standard Oil Company, 910 S. Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY
(Indiana)

STANDARD

National offers you

Top quality O-Rings, dependably uniform, delivered on time!

Here's the way National insures uniform high quality in National O-Rings:

All ingredients are of highest quality, carefully inspected before compounding. Compounding is done under strict controls to insure absolute uniformity of batches. Molding is done on modern equipment by skilled veterans in O-Ring manufacture. Rings are given a complete precision trim, then complete inspection. Every precaution is taken to insure that no O-Rings with cuts, scratches or mold defects are shipped.

A complete line of industrial O-Rings, including the new small cross-section rings, is available for prompt shipment from convenient warehouses. Prices are most competitive. Call the nearest National Applications Engineer and prove this to yourself!

NATIONAL
OIL & GREASE SEALS
O-RINGS SHIMS

NATIONAL MOTOR BEARING CO., INC.

GENERAL OFFICES: REDWOOD CITY, CALIFORNIA
PLANTS: REDWOOD CITY AND DOWNEY, CALIFORNIA; VAN WERT, OHIO

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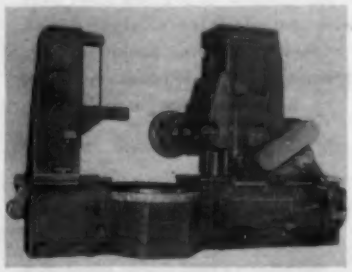
CLEVELAND, OHIO . *210 Heights Rockefeller Bldg., YEllowstone 2-2720*
DALLAS, TEXAS . . . *30½ Highland Park Village, JUstin 8-8453*
DETROIT, MICH. . . . . *726 Lothrop Avenue, TRinity 1-6363*
DOWNEY (Los Angeles Co.), CALIF. . *11634 Patten Rd., TOpas 2-8166*
INDIANAPOLIS, INDIANA . *2802 North Delaware St., WAlnut 3-1535*
MILWAUKEE, WIS. . . *647 West Virginia Street, BRoadway 1-3234*
NEWARK, N. J. . . *Suite 814, 1180 Raymond Blvd., MItchell 2-7586*
REDWOOD CITY, CALIF. . . *Broadway and National, EMerson 6-3861*
WICHITA, KANSAS . . . . *519 South Broadway, WIchita 2-6971*

BRIEFS continued

while the other solenoid transfers clutch connection from exhaust to pressure engaging crankshaft and flywheel drive. As crankshaft rotates

another limit switch is tripped, de-energizing the solenoid for disengaging the clutch, while after another 5 degree rotation the third limit switch is tripped resulting in the engaging of the brake and stopping the crankshaft on top dead center. After all holes of one size are punched a slight touch on the foot switch will automatically swing the next color coded tool into position.

«« Hydraulically operated indexing mechanism on a large Spur Gear Cutting Machine, built by Gould & Eberhardt, Inc., Irvington, permits indexing to start slowly, then accelreate and decelerate upon completion of each indexing cycle. This machine



was developed for rapid and economical production of large diameter and coarse-pitch spur gears. A hydraulic compensating mechanism relieves the load of the work table, fixture and gear blank during indexing and is released automatically during cutting.

A Helical Gear Hobbing Machine which incorporates a hydraulically operated hobbing feed will also be shown.

Continued on page 31

Keelavite

Solenoid-operated

PILOT VALVES

NEAT • ROBUST • COMPACT

This new series of solenoid-operated pilot valves is a notable addition to the existing Keelavite range of sequence and interlock control gear. Its field of application in automatic hydraulic machinery is extremely comprehensive by virtue of the numerous alternative standard assemblies. Identical units may be used for electrically controlled piloting duties or small flow direction control. A further range can be mounted directly on to current Keelavite ¾", 1", 1½" and 2" directional valves to form a composite pilot-operated direction control unit. A gasket mounting type is available for attachment to other equipment.

HYDRAULIC DATA

Working pressure 2,000 p.s.i. • Rated Flow 1½g.p.m. • ¼" B.S.P. ports • Internal and external pressure and exhaust connections • Choice of several standard pistons • Send for data sheet giving installation dimensions.

ELECTRIC DATA

Continuously rated solenoid • Single or double acting • 110-440 volt, single phase A.C. supply • Initial Load 350 v.a. • Closed load 60 v.a. • Terminal box rotatable through 360° • Solenoids housed in stove enamelled covers.

KEELAVITE ROTARY PUMPS & MOTORS LTD.
ALLESLEY, COVENTRY, ENGLAND

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

SECO hydraulic VALVES IN STOCK

Simplex Engineering has had many years of experience in designing hydraulic circuits, and in building all types of hydraulic power and control systems. We have always used the most suitable components obtainable for each application – regardless of who the manufacturer might be. This we still do. Hence we well realize that there are many good *valves* of every type. We have, however, designed numerous valves for our own use – where there was evident a real need for lower cost, or greater simplicity, or the ability to perform at higher pressures. These valves we manufacture in quantity, *and carry in stock*. They are for sale "off the shelf".

SAFETY RELIEF VALVES

For limiting operating pressures. Six models—500 to 10,000 PSI—each adjustable within limits. Chatterless. Relief set by adjusting screw. Hooded, and provided with lock and key.

HIGH PRESSURE CHECK VALVES

Simple ball check passes flow in one direction only. Designed for pressures up to 10,000 PSI.

HANDWHEEL SET RELIEF VALVES

Ideal where quick and frequent adjustment of pressure is required. Three models — 1,000 to 6,000 PSI.

UNLOADING VALVES (Not Illustrated)

Designed to insure high pressure pump unloading at all times except at the interval when pressure is needed.

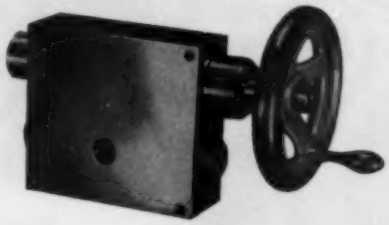
PILOT OPERATED CHECK VALVES

Basically a check valve, but allows free reverse flow when pilot pressure is applied. Seven models cover flow range of 6 to 100 GPM. Max. operating pressure 6,000 PSI.

PILOT OPERATED BLOCKING VALVES

Similar to valve described above except that pilot section is externally drained. For use where back pressure occurs in the inlet line. Models cover same range as Pilot Operated Check Valves.

HIGH PRESSURE 4-WAY VALVES



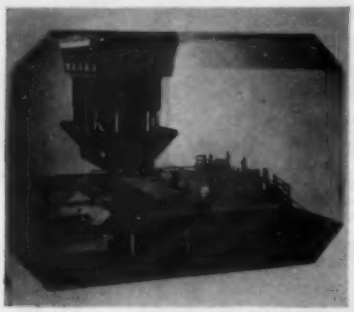
For manual control of many simple hydraulic circuits involving double-acting cylinders. Permits fine graduation of pressure and volume. Body is forged steel. Pressures up to 10,000 PSI.

If you use hydraulic valves you should have the SECO Catalog. Use the reader's service card.

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

BRIEFS / continued

«« A 7-foot working model of a Throatless Press will be displayed by Hydraulic Press Manufacturing Co., Mount Gilead, who developed it with The Austin Company, Cleveland. Designed for substantial economies in capacities over 25,000 tons, pressures up to 200,000 tons or more may be obtained. 360 degree access to the work area is provided by the elimination of the conventional press frame.



Press head, cylinders and slides are suspended from the ceiling of the concrete structure. Hydraulic control and power units are to be housed on top of this press room. Ten hydraulic cylinders will be individually controlled to apply force to the press platen in relation to the shape of the workpiece.

Various models of oil hydraulic frame presses will also be shown.

«« Use of fluid power is seen on lathes to be shown by Jones & Lamson, Springfield. The Universal Saddle Type Turret Lathe (illustrated) is equipped for two-way hydraulic tracing, capable of machining most

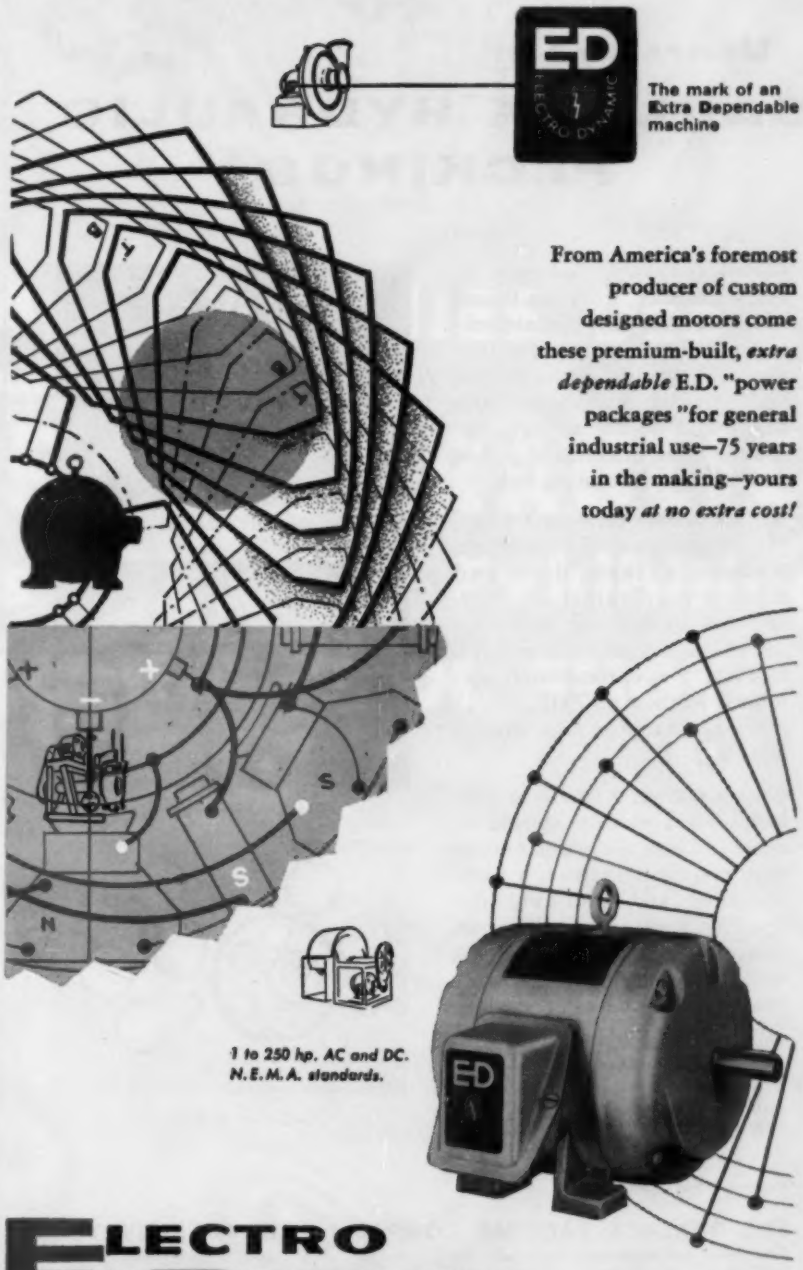
inside and outside contours on chucked work. The two-way hydraulic tracing from the cross-sliding hexagon turret is accomplished by the coordinated movement of its cross-slide and longitudinal slide which is controlled by a single stylus through hydraulic cylinders.

Hydraulic power, enclosed and

Continued on page 32

a better kind of power

FOR INDUSTRIAL MACHINES



The mark of an Extra Dependable machine

From America's foremost producer of custom designed motors come these premium-built, *extra dependable* E.D. "power packages "for general industrial use—75 years in the making—yours today *at no extra cost!*

1 to 250 hp. AC and DC. N.E.M.A. standards.

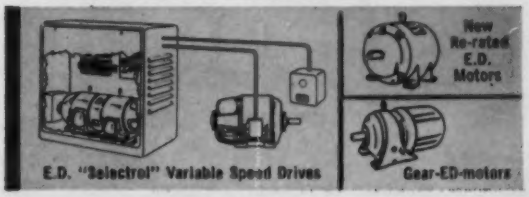
ELECTRO Extra DYNAMIC Dependable motors

PRODUCT OF GENERAL DYNAMICS

NEW...

Write for Brochure 100 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation Bayonne, New Jersey



Users prefer

GARLOCK HYDRAULIC PACKINGS

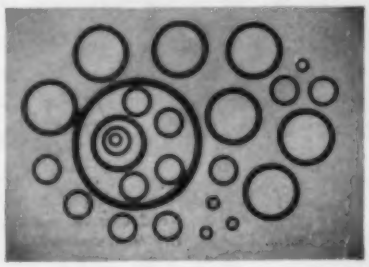
Garlock CHEVRON* Packing • At every pressure, from the lowest to the highest, this popular packing provides a positive, low friction seal. Ideally suited for use on hydraulic cylinders (both single and double acting), hydraulic rams, plungers of pumps and other reciprocating rods.

Garlock CHEVRON Packing

Garlock Leather Packings • Cups, "U" packings, "V" packings, washers, gaskets, discs and flange or hat packings, are available for all types of hydraulic service. Specify Garlock BITAN*, a chrome-and-oak-tanned leather, or THIOTAN* a synthetic rubber impregnated leather.

Garlock Leather Packings

Garlock O-Rings • Made to Garlock's rigid quality standards, these O-Rings are manufactured with precise tolerances, a flash-free finish, and utmost uniformity. 70 durometer rubber O-Rings in all popular sizes are available from any of Garlock's branch warehouses.



Garlock O-Rings

Call your Garlock representative or write for information on hydraulic packings, designating for which type, or types, you desire literature.

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THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

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In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS, RUBBER EXPANSION JOINTS

BRIEFS / continued

compact, is an integral part in the company's new Heavy Duty Automatic Tracing Lathe. Four flow control valves and three drums which operate electrical limit switches comprise the entire set-up for a great variety of combination cuts, feeds and speeds.

«« Rapid, accurate, adjustable pressure control were the operational specifications required to produce deep drawn stainless steel pieces. For this purpose Lake Erie Engineering Corporation, Buffalo, designed this high speed, Double Action Hydraulic Press, which will be seen at their booth in operation. 18½ feet high,

the press combines a 150 ton clamp slide with a 150 ton draw ram. Double action is implemented by a 75 ton hydro-pneumatic cushion assembly. All actions are controlled by pushbutton, including individual control of the four clamp cylinders. Operating on 270 hp, the press approach and return speed is 2000 inches per minute while the draw stroke is made at maximum 460 inches per minute.

«« A hydraulic system in which the table feed circuit is designed so that hydraulic clamping can be arranged without changing the circuit, is the feature of a new small milling machine. Built by Sundstrand Machine Tool Co., Rockford, the C1 Hydraulic

Continued on page 38

Circle 43 on Reader Service Card

Circle 136 on Reader Service Card

These 54 COMPANIES Use VICKERS® HYDRAULICS on Machines They are Exhibiting at the MACHINE TOOL SHOW

Why VICKERS HYDRAULICS PREDOMINATES on Modern Machine Tools

The large number of Vickers-equipped machine tools that you will see in the Show is no accident. It is due to wide recognition of the many advantages of Vickers Oil Hydraulics. Some important reasons behind this preference for Vickers are mentioned here. There are many more . . . the nearest Vickers Application Engineer will be glad to discuss them with you.

LONG-ESTABLISHED QUALITY

Vickers leadership in quality is the summation of many things. Important among these is the program of continuous research that has been maintained through the years and has resulted in a long and impressive list of pioneering developments. Representative of these are: Hydrostatic Relief Valve . . . Balanced Vane Type Pump . . . Flow Control Compensator . . . Axial Piston Pump and Motor. These, and many other developments by Vickers during more than three decades, have contributed substantially to the advancement of hydraulics for machine tools.

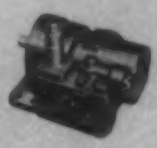
FACTORY-TRAINED APPLICATION ENGINEERS

Thoroughly trained in all phases of oil hydraulics at Vickers plants, this large group of salaried men is exceptionally well qualified to help make hydraulics more useful. They command the wealth of Vickers Hydraulics resources to perform many services . . . from complete circuit design to helping get the "bugs" out of a prototype machine.

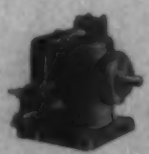
Be Sure to See the VICKERS® Exhibit at the Machine Tool Show, Booth 814.

STANDARD VICKERS UNITS CAN BE COMBINED TO *Economically* PROVIDE EVERY HYDRAULIC POWER and CONTROL FUNCTION

Single Stage Balanced Vane Type Pump . . . the most widely used of all pumps in oil hydraulic service.



Two-Pressure Pump automatically delivers larger volume at low pressure and smaller volume at high pressure.



Variable Delivery Axial Piston Type Pump has low inertia forces, higher rotative speeds and very high efficiency.

Power Unit is a compact self-contained power source that frequently results in design simplification and cost savings.

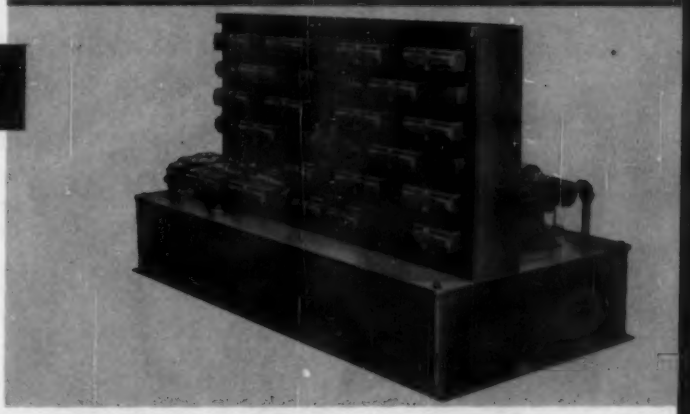
Balanced Piston Type Relief Valve more accurately controls system operating pressure and protects against overload.

"Hydrocushion" Type Pressure Control Valve for control of unloading and sequence of oil flow in hydraulic system.

Why VICKERS HYDRAULICS PREDOMINATES on Modern Machine Tools

FACTORY-TRAINED FIELD SERVICE SPECIALISTS

Vickers equipment is designed and built to hold service requirements to an irreducible minimum. But no machinery built by man escapes service completely. When Vickers equipment requires service, it is handled by full-time Field Service Specialists working out of Vickers offices from coast to coast. These men, carefully trained in Vickers plants, are thoroughly competent to adjust and maintain all Vickers equipment . . . and qualified to instruct customers' service organizations in improving their own hydraulic maintenance practices.



UNDIVIDED RESPONSIBILITY

Many machine builders prefer to use Vickers hydraulic equipment exclusively because it gives them the advantage of undivided Vickers responsibility. Since 1921, Vickers has accumulated a great store of specialized knowledge in hydraulics . . . has developed the extensive line of equipment needed to take undivided responsibility. With Vickers equipment throughout, there is no risk of incompatibility of hydraulic components . . . optimum operation is assured.

For further information, ask for <u>new</u> Catalog 5001A.

STANDARD VICKERS UNITS CAN BE COMBINED TO *Economically* PROVIDE EVERY HYDRAULIC POWER and CONTROL FUNCTION

Adjustable Flow Control Valve that eliminates jumping and speed variation because of load change.

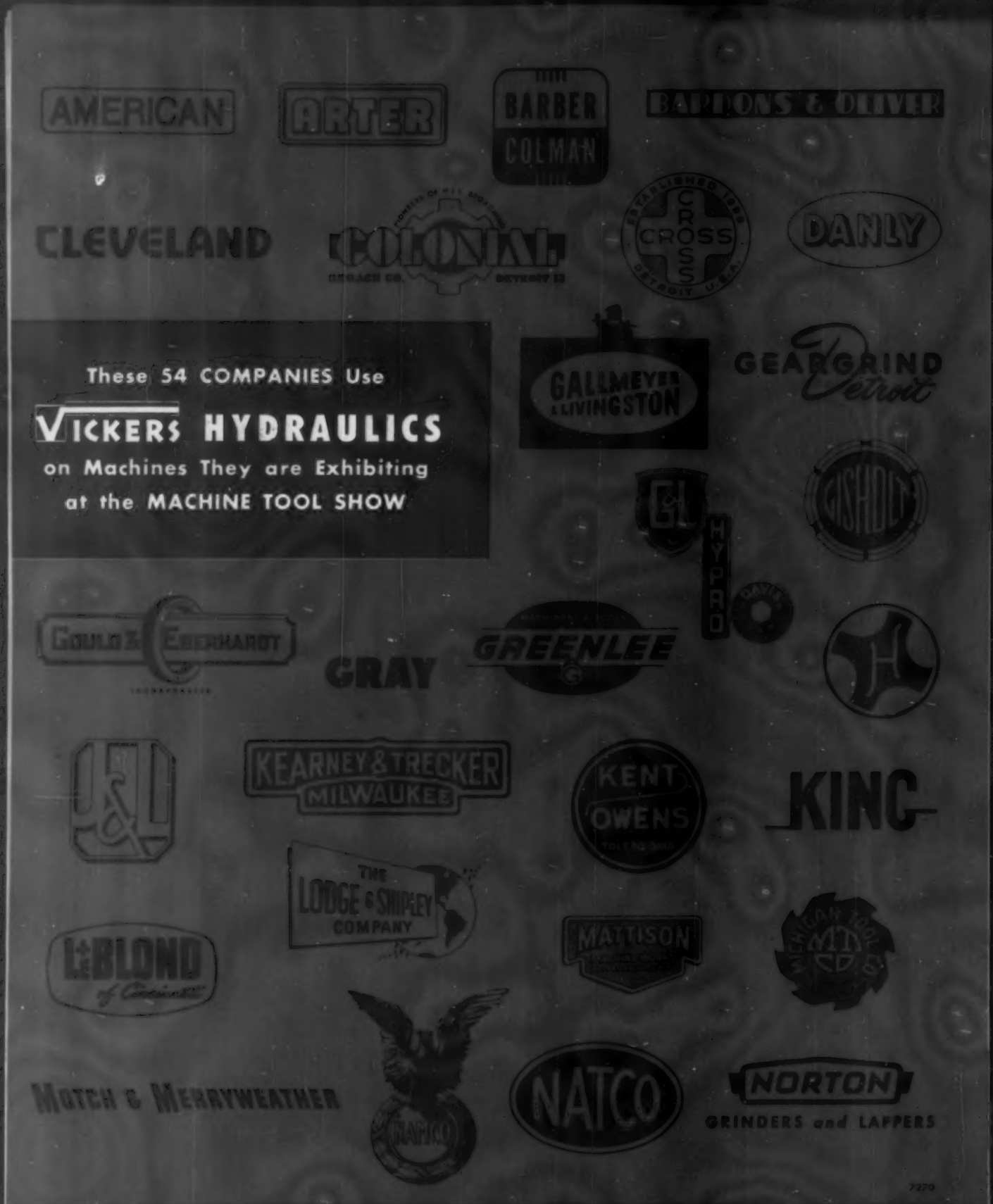
Traverse and Feed Cycle Control Panel provides any sequence of rapid advance, adjustable feed, dwell and rapid return.

Solenoid Controlled Pilot Operated 4-Way Valve for controlling direction of oil flow remotely and electrically.

Deceleration Valve smoothly diminishes (or increases) oil flow as cam mechanism depresses the valve plunger.

Vane Type Hydraulic Motor has hydraulic balance, high efficiency and exclusive "rocking-beam" construction.

"Compact" Hydraulic (Oil) Cylinder has piston rings or improved cup seals and is available in 5 standard mountings.



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IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

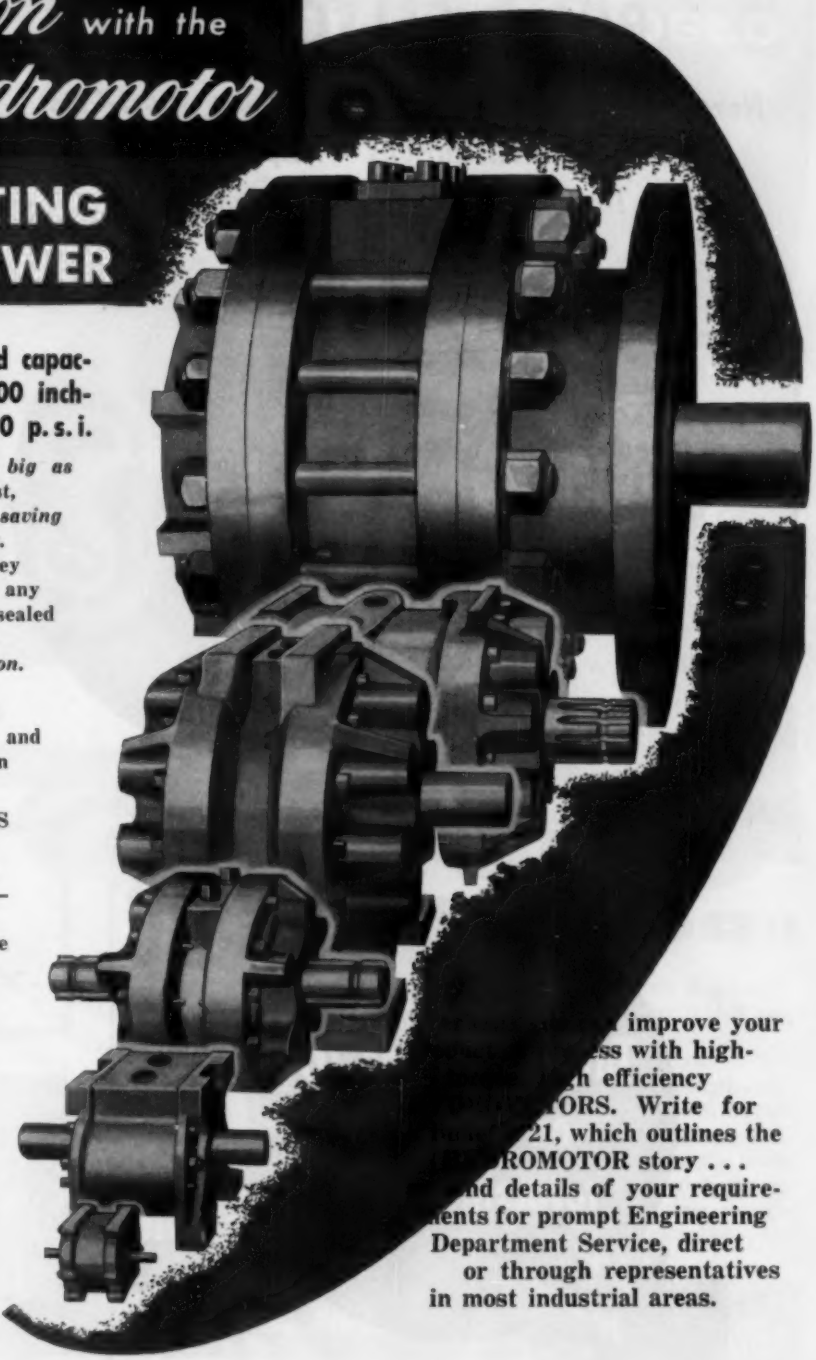
Automation with the Bonnot *Hydromotor*

RECIPROCATING ROTARY POWER

Wide choice of models and capacities from 150 to 1,000,000 inch-pounds of torque at 1000 p. s. i.

From the smallest *(only as big as your fist)* through the largest, *Bonnot* HYDROMOTORS are *saving users time, space and money.* Compact and lightweight, they can be mounted anywhere, in any position and are completely sealed and self-contained to insure *dirt-free, trouble-free operation.* HYDROMOTORS eliminate expensive, bulky mechanical linkages, installation is fast and easy, maintenance is cut to an absolute minimum.

With Bonnot HYDROMOTORS *reliable automation* can be achieved more simply. This reciprocating rotary actuator—operating with air, water or oil—develops instant full torque in either direction. Standard units travel 280° and develop 150 to 500,000 inch-pounds of torque. Double vane units—with maximum travel of 100°—approximately double the above torque values of the single vane unit IN THE SAME SIZE HOUSING. Special sizes are custom-built to individual specifications.



improve your
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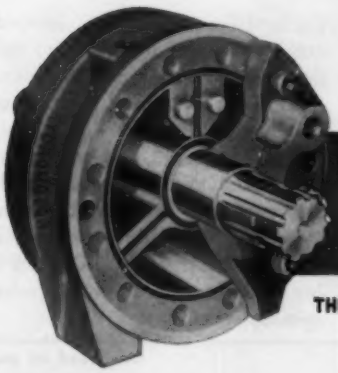


Hydromotor DIVISION

THE BONNOT COMPANY • CANTON 2, OHIO

LOWERING • REVOLVING
LIFTING • PUSHING • PULLING
SWINGING • OPENING
CLOSING • CLAMPING • TURNING
INDEXING • OSCILLATING, ETC.

TUTHILL SIMPLIFIES PUMP SELECTION

New Cataloging Plan Provides Practical Short-Cuts to Pump Specifications — Helps You Pick The Right Pump for the Purpose

If your specifications call for pumps that must be driven by reversing shafts for...

- LUBRICATION
- HYDRAULIC SERVICE
- COOLANT
- CIRCULATING

In capacities from 3/4 to 200 g.p.m. and pressures up to 400 p.s.i.

...Write for Tuthill Catalog 105 on automatic reversing pumps

Catalog 105 presents the complete line of Tuthill automatic reversing pumps. Without the use of check valves, these rotary, internal-gear positive displacement pumps can be driven in either direction of rotation without changing direction of flow or port positions.

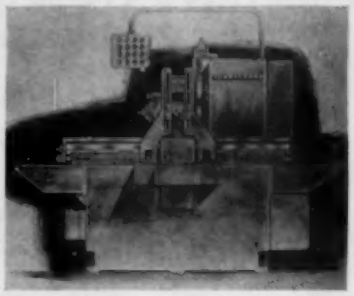
TUTHILL PUMPS FOR THE PURPOSE

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd. • Ingersoll, Ontario, Canada

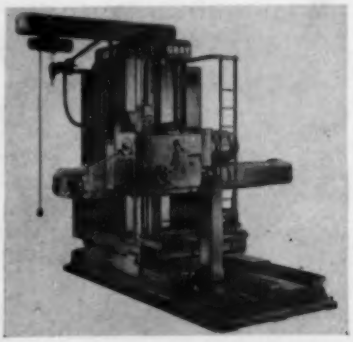
BRIEFS continued

Feed Rigidmil has 5 hp capacity. The machine has hydraulic feed to its table and a maximum stroke of 24 inches. Feed range is from 1 inch to 100 inches per minute with rapid traverse of 350 inches per minute.



Hydraulic pump, valves and controls, built to JIC Standards, are all panel mounted on rear of machine. Company will also show a single vertical spindle cam-controlled hydraulically operated milling machine for both external and internal contours.

«« The G. A. Gray Company, Cincinnati, will show this Floor Type Horizontal Boring, Drilling and Milling Machine, which can clamp hydraulically all the moving elements.



Each of the components clamped are automatically controlled. The hydraulic power unit is mounted on the base of the column at the rear of the machine.

Also displayed will be the company's Handymill, on which the heads and quills are hydraulically clamped. Power unit is within the head itself. Hydraulic clamping is used for holding an internal gear to determine the spindle speed.

Continued on page 40

THE ALL NEW

CAST-IRON TOTALLY-ENCLOSED MOTOR

TYPE J

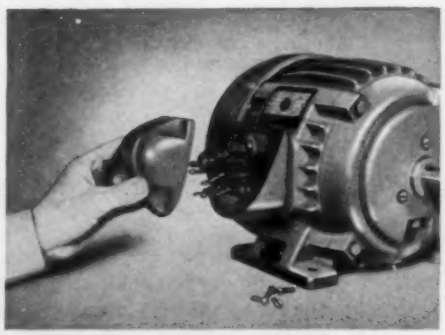
US MOTORS

NEW NEMA RATINGS

The new dimension standards recently adopted by NEMA offered timely opportunity to introduce the new Types J and E, providing more compact power, greatest safety and better value.

with

SPLIT DOME CAST-IRON CONDUIT BOX



The conduit box is a heavy duty, cast-iron, diagonally split type, neatly contoured and easiest of access. It is fitted with a special gasket and is anchored to the case with four screws. Leads are positioned, lugged and clearly marked. The box can be rotated to any of four positions.

U. S. TOTALLY-ENCLOSED

The frame, end bells, fan guard cover and conduit box of the new Type J (Totally-Enclosed) and Type E (Explosion-Proof) U. S. motors are all made of cast iron to offer complete protection against corrosive conditions and external blows. The shock-resistant, cast-iron frame is heavily ribbed for added strength and rapid heat dissipation. The iron grille is cast integrally with the fan guard. It permits maximum flow of air to the ventilating fan, prevents entrance of debris and avoids breakage. These, plus many other exclusive U. S. features such as asbestos-protected windings, Lubriflush transverse lubrication, and normalized castings, make U. S. Totally-Enclosed motors the most advanced concept of complete protection for dangerous duties.

U. S. MOTORS

Mail coupon for comprehensive fully illustrated booklet

U. S. ELECTRICAL MOTORS INC. AH-0
Box 2058, Los Angeles 54, Calif. or Milford, Conn.

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WEAR-SAVERS THAT WON'T STEAL POWER

Hydraulic cylinder makers use Chicago Rawhide's Type G wiper seals for many reasons. Here's one: the special Sirvis leather wiper element holds its own lubricant—operates at low friction. This means negligible power loss. Another advantage: the Sirvis leather element will not trap grit and carry it—will not score the shaft. Years of dependable performance have demonstrated the ability of C/R Type G Oil Seals to exclude dirt, dust and moisture. They may be the answer to your problem, too. Write for your copy of "C/R Perfect Oil Seals."

C/R PERFECT Oil Seals

More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device.

CHICAGO RAWHIDE MANUFACTURING COMPANY

1301 Elston Avenue OIL SEAL DIVISION Chicago 22, Illinois

IN CANADA: SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO

Other C/R products

SIRVENE (Synthetic rubber) diaphragms, boots, gaskets and similar parts for critical operating conditions • CONFOR: Controlled porosity mechanical leather packings and other sealing products • SIRVIS: Mechanical leather boots, gaskets, packings and related products.

BRIEFS / continued

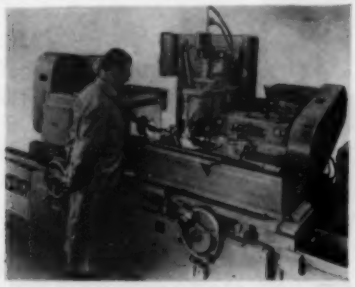
«« Use of three power cylinders and a special hydraulic valve gives this press, built by Clearing Machine Corporation, Chicago, two different combinations of tonnage and pressing speed on the down stroke in addition to rapid approach and return. Capacity of the press is 300 tons. Only a single main motor and pump are used. Combination of tonnages and speeds within a stroke permits

greater production output of the press by shortening the non-working portion of the cycle, and also by speeding up the lower tonnage portions of the draw.

A recently developed hydraulic de- also be on display. This unit places a vice, which will give overload protection for mechanical presses will hydraulic cushion under the slide adjustment mechanism, and if an accidental overload beyond the preset tonnage is encountered, the hydraulic units will compress, thus avoiding damage to mechanism or sticking the press.

«« Completely automatic operating cycle for the production of automotive type camshafts is accomplished by the Automatic Hydraulic Cam Grinder, made by Norton Company, Worcester. Applicaton of hydraulic power has reduced the time required in the grinding of each cam. The large diameter wheel feed screw is hydraulically rotated. Table movement, automatically controlled, is by means of a hydraulic cylinder attached to the underside of the sliding

table. Hydraulic pilot valves and a special multi-circuit valve have greatly simplified the hydraulic con-

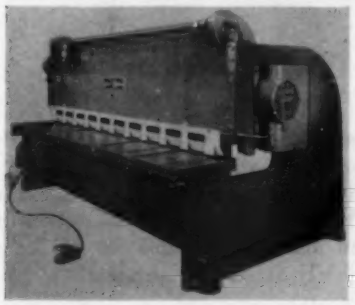


controls and eliminate many switches, relays, solenoids and much of the piping formerly required.

Among other machines displayed by this company will be a Transfer Type Crankpin Grinding Machine with hydraulically controlled transfer mechanism. A Semi-Automation Anglar Wheel Slide Grinder which eliminates an external operation by grinding thrust surfaces and adjacent diameters simultaneously in a single automatically controlled plunge grind. This machine is equipped with a hydraulically rotated micro-screw feed for fast sizing.

Twenty-seven types of machines, using fluid power, are shown in these Briefs. These machines will be exhibited in Chicago's International Amphitheatre, September 6 to 17, where the Machine Tool Show is being held.

«« Power Squaring Shear to be exhibited by Lodge & Shipley Company's Hamilton Division, uses a distinctive air-oil-electric system. In this



system the holddown fingers are brought down on the material gently and then tremendous holding power is developed before the blade cuts. This system has also been incorporated in other shearing machines to be presented.

Continued on page 42

PRECISION MOLDING SOLVES PUMP PROBLEM

It's licked: the problem of low efficiency in gear pumps at 1500 psi caused by hydraulic oil by-passing the gear teeth. Working from Cessna's unique design, C/R developed this Sirvene (synthetic rubber) gasket seal that equalizes the pressure of its effective areas with that within the gear chambers. It seals effectively at 1500 psi with temperatures up to 170° F., and would be suitable for pressures and temperatures above those encountered in operation. The extremely close tolerances to which this Sirvene part is made are vital to the pump's greatly increased efficiency and life.

WHENEVER you need a flexible molded part, produced in quantity with the utmost precision, you need C/R Sirvene. Write us for your copy of "Engineering with Sirvene."

C/R SIRVENE
SCIENTIFICALLY COMPOUNDED ELASTOMERS

CHICAGO RAWHIDE MANUFACTURING COMPANY

1301 Elston Avenue SIRVENE DIVISION Chicago 22, Illinois

IN CANADA: DISTRIBUTED BY SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO

EXPORT SALES: GRON INTERNATIONAL CORP., GREAT NECK, NEW YORK

Other C/R products

OIL SEALS: Shaft and end face seals for all types of lubricant retention and dirt exclusion • CONPOR: Controlled porosity mechanical leather packings and other sealing products • SIRVIS: Mechanical leather boots, gaskets, packings and related products.

"Quality without compromise"

JLE

JLE SQUARE CYLINDERS

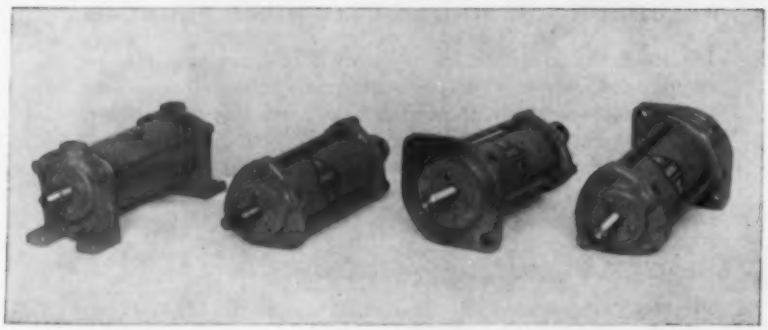
The full line from 1½ to 16 in. bores is available with interchangeable stock mountings and automatic cushioning action on standard types (Adjustable valve cushioning on special types.)

The Square Cylinders are designed for low and medium pressure air and oil service, 250 psi pneumatic, 500 psi hydraulic.

MEETS J. I. C. STANDARDS

The JLE Square Cylinders are simply designed, exceptionally rugged and built of highest quality materials, which insures top performance at lowest possible cost.

"WORKHORSE" AIR CYLINDERS



TYPE AD-5-DA TYPE BD-5-DA TYPE CD-5-DA TYPE DD-5-DA

JLE "Work-Horse" Air Cylinder—the dependable cylinder at a "Work-Horse" Price! Developed for our own use, the cylinder is designed for pressures to 250 psi. The "Work-Horse" Cylinder is available in bore sizes from 1½ to 10 in., in four standard mountings and furnished in both cushioned and non-cushioned models.

Send for the new JLE Cylinder Catalog HP 109

JAMES L. ENTWISTLE CO.

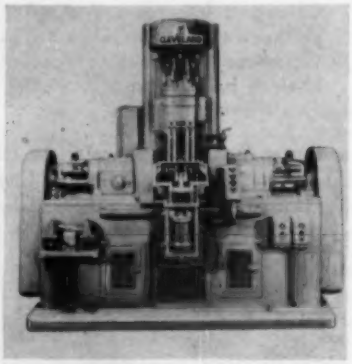
PLANT and EXECUTIVE OFFICE:
1475 ELMWOOD AVE., CRANSTON (PROV. 7), R. I., U. S. A.

BRIEFS continued

«« 450 pieces of main crankshaft bearing cap clusters per hour, at 100 percent efficiency, are produced on this Automatic Transfer Machine, built by The Cross Company, Detroit.

Constructed to JIC Standards, the machine has 19 stations, for loading, milling, drilling, chamfering, reaming, tapping and visual inspection. Hydraulic power is used for feeding the tools, transfering and clamping the work pieces.

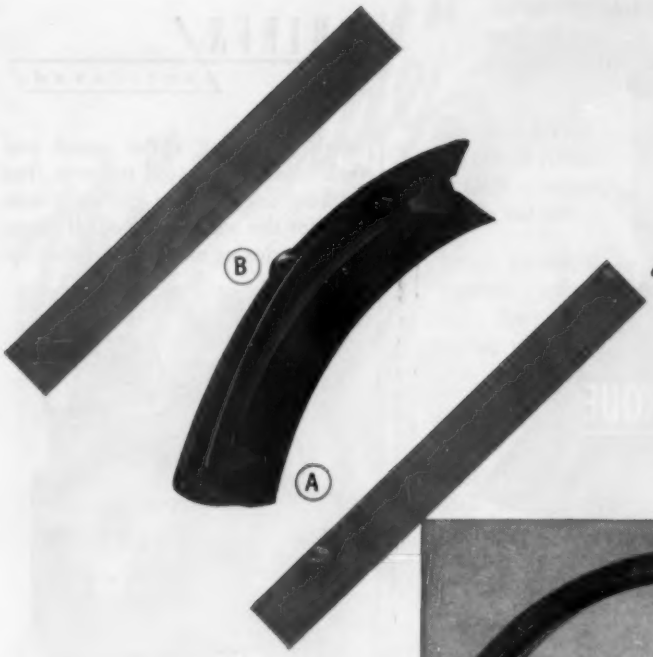
«« Air pressure clamps the fitting blanks while they are tapped on the Series F Tapping Machine, made by the Cleveland Tapping Machine Company, Canton. This machine can also



be used with special hydraulically or penumatically operated feeding, clamping and positioning devices and the drill-tapper can be furnished with an air cylinder table lift for completely automatic operation.

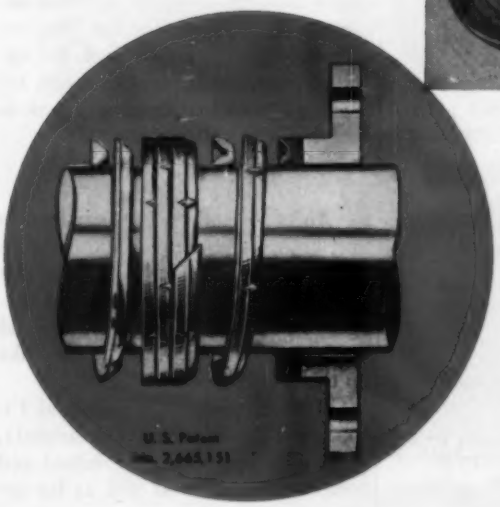
«« Thread Milling Machine, completely hydraulic in operation, will be featured by the Hanson-Whitney Company, Division of the Whitney Chain Co., Hartford. Hydraulically actuated work head and cutter head

Continued on page 44



Really leakproof!

Linear VEE-DAM® rings



HERE'S A UNIQUE, revolutionary split V-Ring design that positively stops both labyrinth flow and lateral leakage!

LINEAR VEE-DAM RINGS don't require precise fitting. Even when gaps occur at the ring joints, through careless installation or variations in bore size, fluid can't leak past the rings. Here's why: *Sturdy Rubber Dams* (A) in the grooved hinge area hermetically seal off center groove sections. When rings are stacked together, these dams eliminate all labyrinth flow. *External abutments* (B) on the ring shoulders prevent lateral leakage and provide stabilizing support.

Let us show you how **LINEAR VEE-DAM RINGS**, engineered to your application in a choice of fabric reinforced synthetic rubbers, save you installation and maintenance time, and assure you absolutely leakproof packing over a wide temperature range.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

The new **ROPER**
HYDRAULIC PUMP-MOTOR
for Improved **INDUSTRIAL SERVICE**

Designed by the same engineers who developed the famous Roper Rotary Pumps, the new Roper Hydraulic Pump-Motors operate on the same principle using two equal size, smooth-running gears in a precision-fitted case. These units offer low-speed and high-torque (much needed in the hydraulic field), and their versatility finds them well-suited to heavy-duty service within their operating range. They run equally well in either direction both as pumps or motors . . . they can be direct-connected without speed reducers, thus conserving space . . . they are easily installed, easy to operate, and are long on economy. Perhaps *you* have equipment that can be further improved with a Roper Hydraulic Pump-Motor. Send for all the facts today.

PERFORMANCE CHARACTERTISTICS
Available in foot and flange mounted models. Recommended speed range on larger sizes is from 200 to 800 RPM with pressures to 800 PSI In this range, Roper units require from 7 to 40 GPM flow and will develop up to 11.5 HP output at maximum speed and pressure. Smaller sizes may be operated up to 1200 RPM and up to 800 PSI which will require a flow of 16 GPM to develop up to 5 HP.

SEND FOR BULLETIN 22

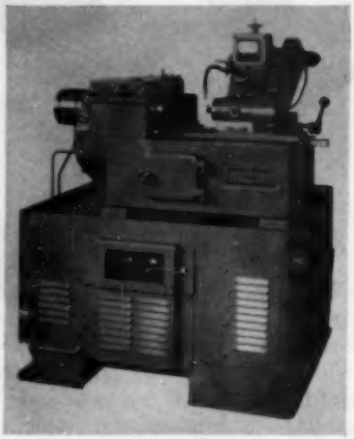
ROPER
Rotary Pumps

GEO. D. ROPER CORPORATION • 709 Blackhawk Park Ave., Rockford, Ill.

Circle 111 on Reader Service Card

BRIEFS / continued

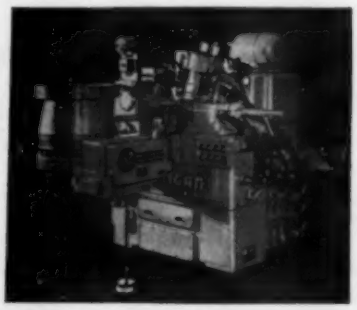
permit balancing cutter speed and work speed, plus rapid traverse, thus resulting in optimum cutting conditions for the work involved. Hydraulic collet closing mechanism is fast op-



erating, and will accommodate long shafts through center hole. Semi-automatic in operation, the machine has all controls easily accessible to the operator. Hydraulic power package, including extra capacity supply tank is enclosed within base.

«« An automatic gear production line, known as Gear-O-Mation will be on display at the booth of Michigan Tool Company, Detroit. The advantages of fluid power have been utilized on the various machines which make up this unit.

On the Model 1445 Universal Ultra-Speed Gear Hobber (illustrated), hydraulics is used for the infeed and traverse movement as well as for the



return of the hob to starting position. Another advantage using hydraulics here is that the interrupted cycle button allows the hob to be removed out

Continued on page 46

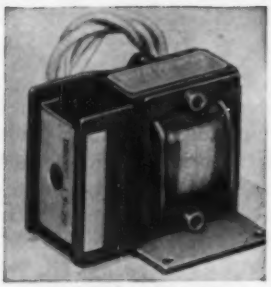
the "inside" story!

SILICON STEEL LAMINATIONS—give high efficiency.
HARDENED BERYLLIUM COPPER PLUNGER GUIDE — reduces friction and wear.
SHOCK-ABSORBING BUMPERS — reduce self-destruction, cushion stroke, assure longer service.
HEAVY SILICONE INSULATED MAGNET WIRE — wound on high flow point molded nylon bobbin.
TEMPERED STEEL SPRING — absorbs vibration — holds assembly firmly in alignment.

of dependable

Decco

INDUSTRIAL SOLENOIDS



HORIZONTAL PUSH-TYPE WELDED BASE

VERTICAL PULL TYPE SHOCK-MOUNTED

VERTICAL PUSH-TYPE WELDED BASE

AC WAFER SOLENOID

DC INDUSTRIAL SOLENOID

In addition to all the "inside" advantages, Decco Solenoids are compactly designed and thoroughly impregnated with silicone baking varnish for high moisture resistance.

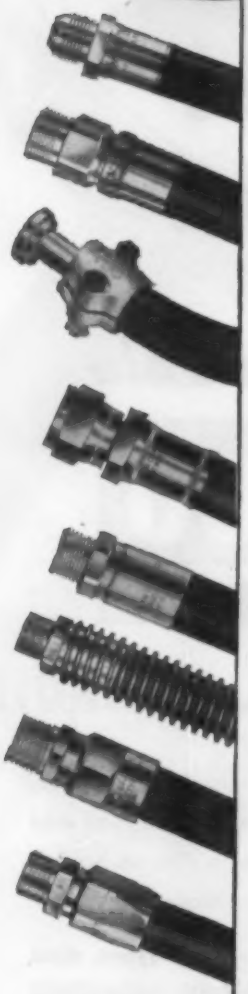
Decco Solenoids are made in all types, sizes and shapes. SPECIAL SOLENOIDS ENGINEERED TO YOUR PROBLEMS.

FOR COMPLETE INFORMATION ON ALL DECCO INDUSTRIAL SOLENOIDS WRITE:

Decco

DETROIT COIL COMPANY

2435 HILTON ROAD, FERNDALE 20, MICHIGAN



ANCHOR
Hose Assemblies
Serve and Serve!

Who said so?

Our customers—those who have reason to KNOW. Right here is where you can begin to profit by forming your own opinion based on first-hand experience. First, however, let us know your problem so we can offer our many years of hose assembly experience in getting you rolling with the *right hose* and the *right couplings* for your purpose. Send us your installation data, including medium to be carried, temperatures, pressures and general specifications.

Write for our catalog describing all standard Anchor Assemblies.

ANCHOR COUPLING CO. INC.

376 North Fourth Street • Libertyville, Illinois

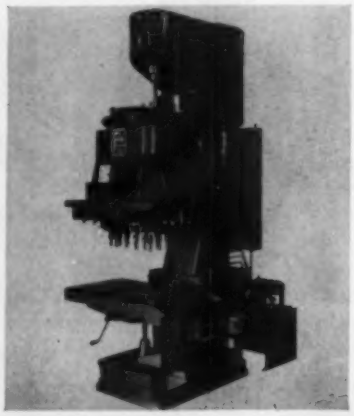
Branch Offices: Dallas, Tex.; Plymouth, Mich.

BRIEFS continued

of the way and stopped in any position of the cut.

Hydraulics is used to raise and lower the cutting head of the Shear-Speed Gear Shaper. A 30 gpm and a 1 gpm pump are provided, the high volume pump raising the cutter head, and the low volume pump keeping it in place. In the Roto-Flo Spline Rolling Machine, hydraulic power for the forming rack has eliminated the need for stopping and starting the motor and also permits a longer movement. It has also provided greater speed flexibility and has virtually eliminated backlash by restricting the outflow of the cylinder.

«« All hydraulic and electrical features which have been found necessary for accurate, high production operation, have been incorporated in this Vertical Multiple Spindle Drilling and Tapping Machine. Built by The Fox Engineering Company, Jackson, it provides hydraulic feed



drilling and lead-screw-feed tapping. Head and slide are hydraulically counterbalanced. Drill and tap cycles are automatic. The hydraulic components are readily accessible and should service on the cylinder be necessary, it may be removed without disassembly of the head or the overhead drive components.

«« Latest models of Gear Shaving Machines, some of which feature air operated head and tailstocks, auto-

Continued on page 48

REVOLUTIONARY IDEA?

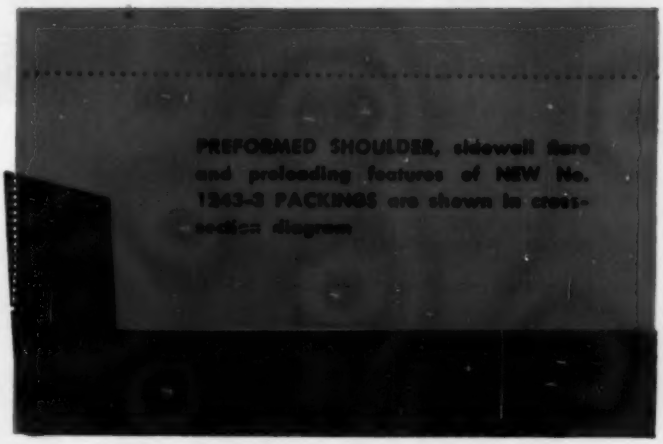
YES . . . NOW HOUGHTON'S NEW PACKING DESIGN IS PROVED BY PERFORMANCE

Here's what years of testing and actual performance records have established about the benefits of *Vim No. 1243-3 preformed, preloaded Packings:*

- 1. Leaks at low pressure are eliminated!
- 2. Packings won't rupture at top pressures!
- 3. Friction is substantially reduced!

The widening use of these unique cup packings has also served to upset the general belief that synthetic rubber could not be thoroughly impregnated in leather. Houghton engineers have demonstrated in No. 1243-3 that *the advantages of both can be combined for greater effectiveness!*

Ask the Houghton Man for more detailed information. Or write to Packing Research Department, E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, Pa.


PREFORMED SHOULDER, sidewall flare and preloading features of NEW No. 1243-3 PACKINGS are shown in cross-section diagram

VIM NO. 1243-3 RUBBER IMPREGNATED LEATHER CUP PACKINGS

. . . a product of

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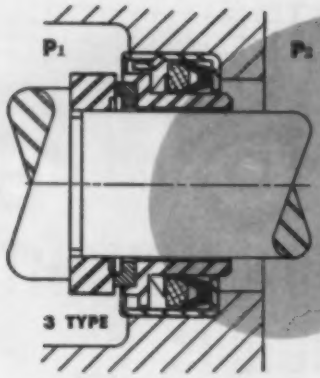
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

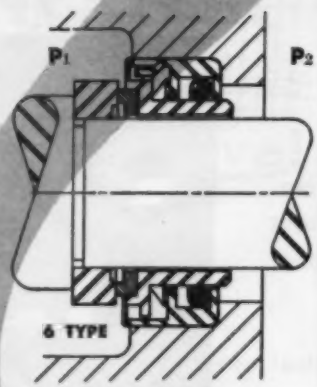
Ready to give you on-the-job service . . .



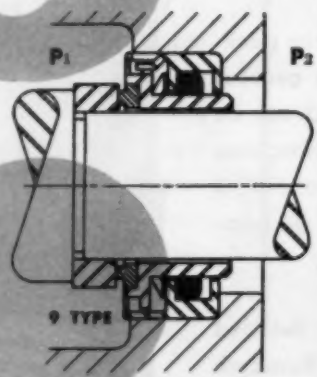
P1 greater than P2
350 psi maximum differential

WHICH SEAL FOR YOU?

Don't spend precious time designing rotary shaft seals when Sealol can do the job for you. Sealol designs and manufactures positive sealing, Balanced Pressure Mechanical Face Seals to satisfy a variety of sealing conditions. Seals now in use are successfully handling pressures ranging to 1,000 psi, shaft speeds to 15,000 FPM, and temperatures up to 500° F. Conditions in excess of these figures can be met by specially designed seals incorporating the basic Sealol principle. We invite the opportunity to share your shaft sealing design problems. Send for engineered recommendations based on your operational and dimensional data. Write today!



P1 greater than P2
1000 psi maximum differential



P2 greater than P1
350 psi maximum differential

SEALOL CORPORATION, 181 POST ROAD, PROVIDENCE 5, R. I.

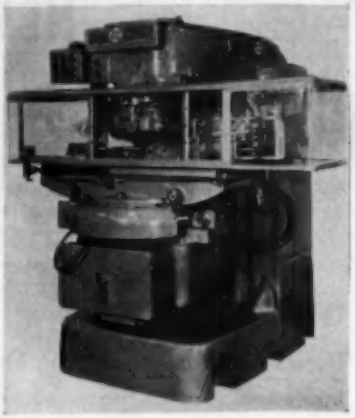
New York • Philadelphia • Chicago • Cleveland • Dallas • Houston • San Francisco
Los Angeles • Charleston (W. Va.) • Norfolk • Seattle • St. Louis • Tulsa • Edmonton
Toronto • Montreal (Can.) • Manchester (Eng.) • Paris • Frankfurt

SEALOL

THE BALANCED PRESSURE SEAL

BRIEFS continued

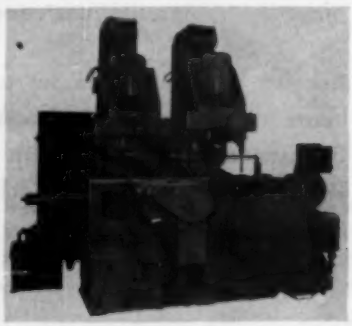
matic and semi-automatic loader mechanisms, will be displayed and operated by the National Broach and Machine Co., Detroit. Model illustrated here employs two air cylinders,



the long stroke cylinder in front opens and closes a splash guard, the other cylinder controls the tailstock for clamping the work. This equipment will shave automotive transmission helical gears.

This company will also show a self contained air powered broaching fixture for broaching small parts.

«« A three-Unit Transfer Machine, patterned after the Two-Unit Machine illustrated here, will be featured by Baker Brothers, Inc., Toledo. The machine, which incorporates hydraulics,



was designed for combination boring and counter-boring at one station, cross feed facing at another and multiple drilling at the third station. The hydraulic power package is readily accessible for easy maintenance.

Continued on page 50

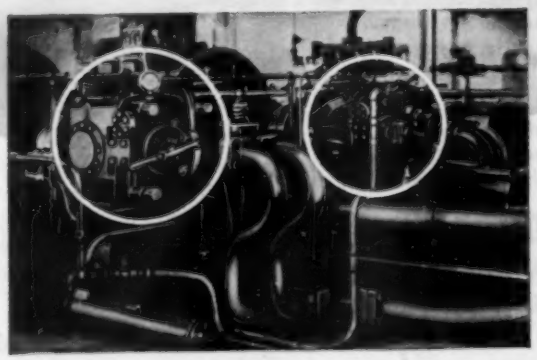
SERVING MODERN INDUSTRY

'VSG'

Regd. Trade Mark

Infinitely

VARIABLE SPEED HYDRAULIC TRANSMISSION GEARS



This Transporter erected at Al-Fatha, Iraq, was supplied to the Iraq Petroleum Co. primarily to carry plant and material for building the new pipeline from Kirkuk to the Mediterranean and was designed and built under the supervision of the British Ropeway Engineering Co. of London. The carriage winch incorporates 'VSG' drives fitted with special cam control gear to regulate the loadcar speed automatically throughout its journey.

VICKERS-ARMSTRONGS LTD

VICKERS HOUSE · BROADWAY · LONDON · SWI · ENGLAND · Cables: Vicastrong, London

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You can really *save* with Page Packings . . . in many ways . . . for with Page Packings you get more than just full, honest value in well-made packings. You get the willing helpfulness and sincere interest of qualified packing engineers . . . backed up by a large, dependable Company with packing know-how accumulated in 87 years of experience.

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Page offers you a complete line of leather packings made from various leathers, with various treatments, and with special impregnations for particular applications . . . and a complete line of standard synthetic packings . . . U's, V's, Cups, Flanges and O-Rings. It will pay you to always consider Page . . . for in the long run Page Packings will save you money.

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PAGE BELTING COMPANY

Established 1868

Concord, New Hampshire

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PAGE PACKINGS

Engineered to do a better job

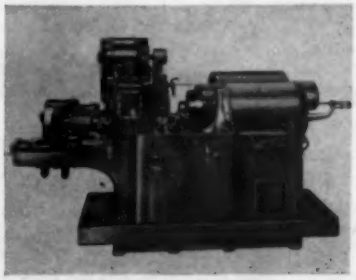
BRIEFS / continued

«« This 4 inch Eight Spindle Automatic Bar Machine is one of three new models to be displayed by The National Acme Company, Cleveland. Hydraulically powered functions are

included in this machine which produces bearing races, 2 at a time, in a machine cycle time of 21 seconds.

A 5¼ inch Six Spindle Hydraulic Chucking Automatic to produce housing caps from bronze casting in a machine cycle time of 13 seconds will also be seen.

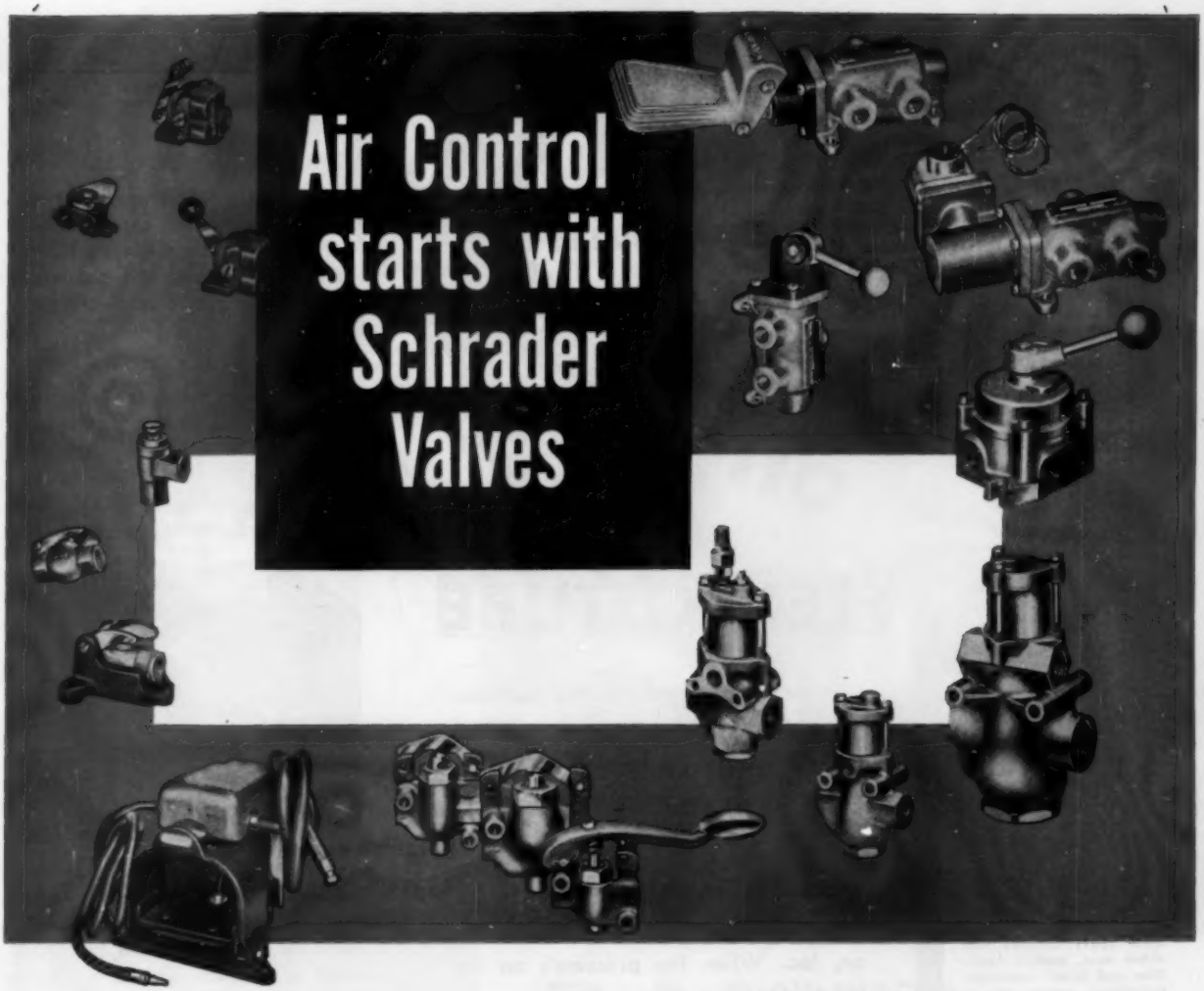
«« An automatically air-operated clutch provides two additional spindle speeds, to the two provided by a 10 hp two-speed spindle motor, on the 2½" Model AW Single Speed Auto-



matic (illustrated) built by The Cleveland Automatic Machine Company, Cincinnati. The 3" Model AB, also to be exhibited is equipped with hydraulically operated clutches both in the feed bracket and spindle head.

«« Horizontal Broaching Machine which features a variable speed hydraulic circuit will be shown by The Lapointe Machine Tool Company, Hudson. To avoid downtime and maintenance troubles a sealed reservoir is used. Sufficient reservoir capacity is incorporated to maintain the temperature of the hydraulic oil at

Continued on page 52



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Find out how Schrader Valves can put compressed air to work to save you money. For specification data, write—or, if you prefer, fill out the coupon below.

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FLEX-O-TUBE®

If pressure is a factor in the performance of your product, you can rely on Flex-O-Tube. For here is a name that has stood for uniformity of high quality for twenty-five years.

And just as important, the Flex-O-Tube organization is one that you can rely on, too. When the pressure's on for production you can count on prompt deliveries of flexible hose products that consistently meet specifications.

These are but two of the reasons why industry has used miles and miles of Flex-O-Tube and continues to specify it in increasing quantities. Why don't you find out for yourself by "putting the pressure on Flex-O-Tube"?

Supplied in Assemblies

Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

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Company .....

City ..... Zone ..... State .....

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FLEX-O-TUBE

DIVISION OF MERIDAN CORP.

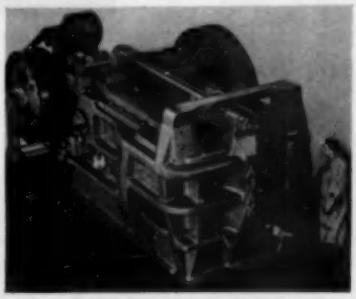
2527 JIM DALY ROAD • INKSTER, MICHIGAN

Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

BRIEFS continued

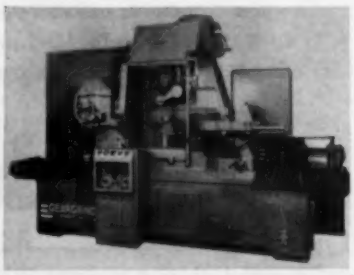
the point of greatest operating efficiency. Cutting speeds can be instantly adjusted. Other machines exhibited will have hydraulic and pneumatic actuated clamps in their work holding fixtures.

«« Accurately adjustable torque regulation of the air clutch affords reliable safety overload protection on the Forging Machines made by The Ajax Manufacturing Company, Cleveland. On forgings such as gears and



pinions where it is desirable to confine the metal and subject it to tremendous pressures, these air clutch machines are ideally adapted. Illustrated is a 3 inch air clutch forging machine.

«« To achieve high production, the fully automatic Spline Grinding Machine, developed by Gear Grinding Machine Co., Detroit, employs hydraulic power on some of its operations. A sandwich manifold contain-

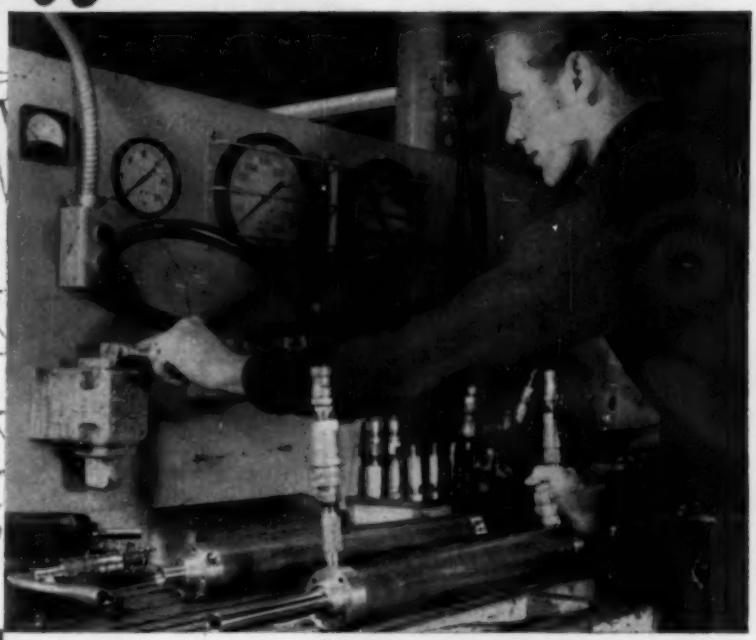


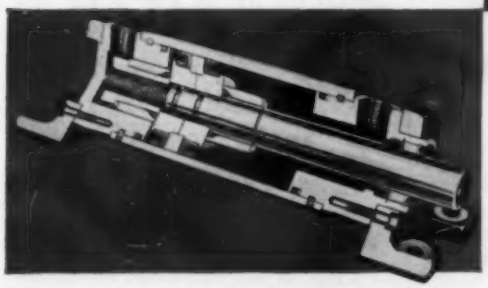
ing the hydraulic circuitry is used on this machine. This has simplified piping layout and reduced leakage. Another feature is that coolant through the grinding wheel supplies a controlled flow of cooling and lubricating fluid to the working area.

Continued on page 54

PRE-TESTED!

to assure dependable performance





and O-M CYLINDERS

fit where others won't

O-M CYLINDERS
(air • hydraulic)

Complete testing facilities at our modern new assembly plant take the guesswork out of cylinder performance. Before shipment every O-M Air and Hydraulic Cylinder is "power-tested" and approved, assuring dependable prolonged service under all normal operating conditions.

Standard, semi-standard, "special" air and hydraulic cylinders available in full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. Completely interchangeable parts.

Immediate delivery on many sizes.

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for FREE catalog, complete set of ½-scale templates, showing all cylinders, mounts and mounting brackets.

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☐ Have representative call ☐ Send latest catalog ☐ Send ½-scale templates

Name_____ Position_____

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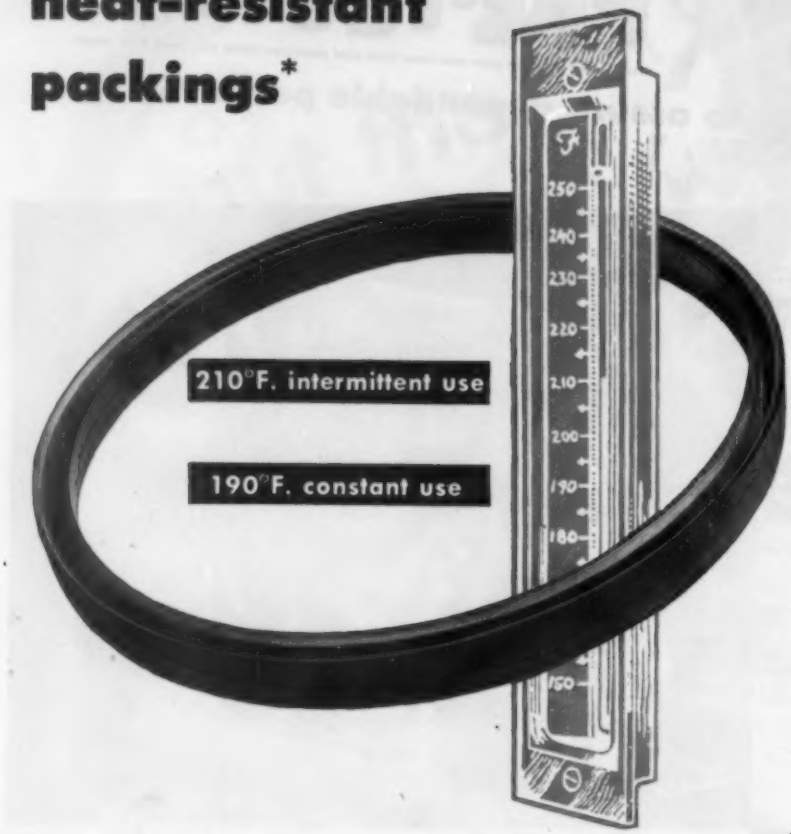
Specify NEW Tannate® heat-resistant packings*



Rhoads has recently developed a new heat-resistant leather for hydraulic and pneumatic applications.

During the last several months, these packings have been tested in the field under a variety of difficult operating conditions.

This new Tannate leather has consistently outperformed the best of the previous leathers under higher temperatures and we are now proud to include it in our line. When specified, they will be supplied at no extra cost.

Tannate heat-resistant packings are recommended for temperatures up to 190° F. continual use or for intermittent use up to 210° F.

Tannate packings will not readily cold flow or score the most highly finished surface. They provide an effective seal against hydraulic oils and many other gases and liquids.

Tannate has a low coefficient of friction . . . is custom impregnated for high or low pressure operation —precision molded and accurately finished to fit snugly against shafts and cylinder walls.

For further details write J. E. Rhoads & Sons, 2100 W. Eleventh St., Wilmington 99, Del.

*Available in U, Vee, Cup, Flange and disc for hydraulic and pneumatic equipment. When ordering please specify Tannate Heat-Resistant packings.

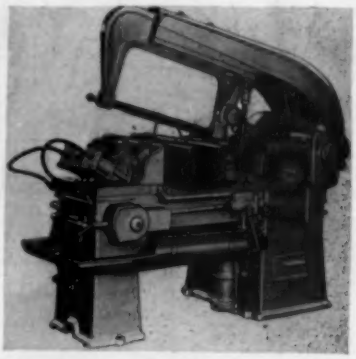
RHOADS

INDUSTRIAL LEATHERS

WILMINGTON • NEW YORK • CHICAGO • ATLANTA

BRIEFS continued

«« A compact low pressure hydraulic system centralizes operating control and provides smooth oil cushioned operation on Heavy Duty Saws manufactured by Racine Hydraulics & Machinery Inc., Racine. Series No. 30 (illustrated), is available in three capacities. A sensitively controlled



hydraulic cutting feed provides for precision sawing of all metals. The exact amount of oil to be delivered for each cutting stroke is controlled by an adjustable, simple metering device with graduated dial.

The new hydraulic Utility Saw, Model 816, which combines the important features of wide utility and large capacity will also be exhibited.

Chicago September 6-17 Exposition Briefs

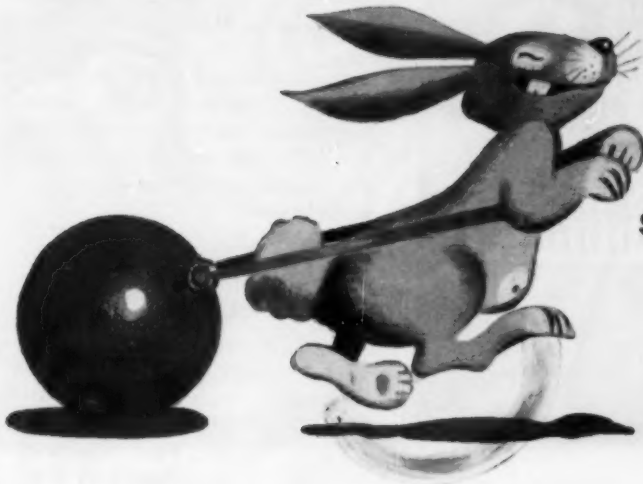
Many of the hydraulic and pneumatic components, lubricating systems and electronic devices used on machine tools will be shown at the **Production Engineering Show** at the **Navy Pier.**

Direct shuttle bus service and a helicopter service will be offered to take visitors from the Navy Pier to **The National Machine Tool Show** at the **International Amphitheatre.**

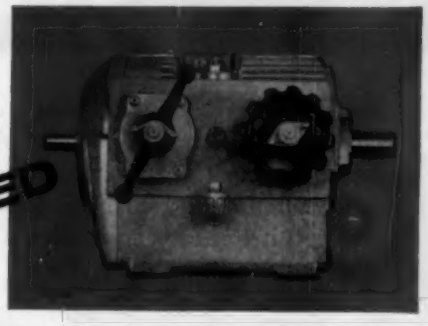
New, improved and special purpose metalworking machinery will be featured at the **Metalworking Machinery and equipment Exposition** at the **Coliseum.** This show will remain open every evening until 10:30 to permit visitors to the other two shows to attend. ▼▼▼

some need it FAST

some need it SLOW



some need VARIABLE SPEED

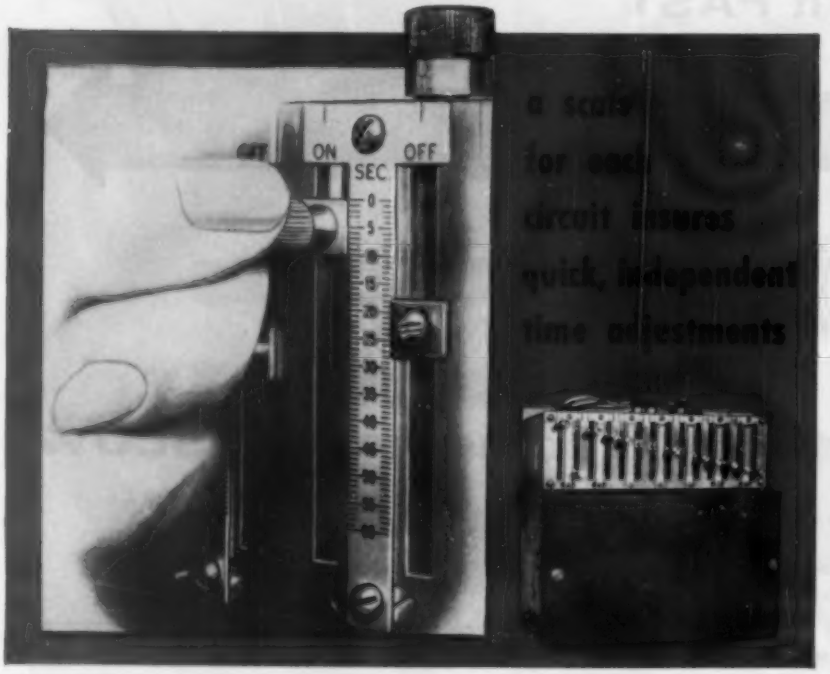


to make production flow

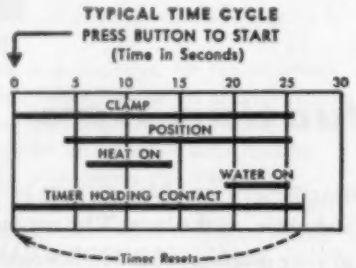
. . . chances are, if you're playing tortoise and hare on your production line, you're trying to put a rocket on the turtle and a ball and chain on the hare. Why not inquire about the new GEROTOR transmission and its application to your problem. GEROTOR would welcome the opportunity to tackle your problems on variable speed and show you how a GEROTOR VARIABLE SPEED HYDRAULIC TRANSMISSION can solve those problems . . . and many, many more. *Why not write today?*

1535 MARYLAND AVENUE • BALTIMORE 3, MARYLAND

EAGLE MULTIFLEX
(multiple circuit) reset timer



For controlling operation phases of electrically energized devices in processing work. The Multiflex Reset Timer closes and opens one to six circuits during a time interval started by push button, limit switch or other means. It's the only multiple circuit timer that provides a calibrated scale for quick, independent adjustment of each circuit. Time changes are made rapidly by moving a simple slide adjustment. Settings are possible to 1% of full scale. Vernier knobs are provided for use where more accurate settings are required. Multiflex Timers are available with time scales from 30 seconds to 5 hours. Send for free bulletin.



(0.4 seconds reset time required from full scale setting)

MAIL COUPON TODAY

EAGLE SIGNAL CORPORATION
Industrial Timers Division, Dept. AH-955
MOLINE, ILLINOIS

Please send Bulletin 130 containing full data on Multiflex Reset Timer.

NAME AND TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

LETTERS to the editor

"Lip Seal" Data

I would like to receive the standards on seals and sealing materials, especially the data on "lip seals". I would also appreciate a list of manufacturers of "lip seals".

PAUL F. OSWALD
Thomson Machinery Co., Inc.
Thibodaux, La.

Joint Industry Conference (J.I.C.) Standards supply some information on recommended sizes for "U", Cup and "V" packings. We have sent you a list of packing manufacturers.

Wants Hydraulics Beginner's Course

Is it still possible to get reprints of the beginner's course articles on hydraulics which were published in 1950 and 1951?

PAUL HARDMAN
New York City

No reprints of this series are available. The engineering data section of THE MASTER CATALOG OF FLUID POWER, *which will be published in October will provide you with an excellent source of basic data.*

Mighty Small Pump

We are looking for a very small hydraulic pump and a small hydraulic motor. The displacement of the pump we have in mind would be about .025 cubic inches per revolution. The smallest pump we have located so far is the model 1201 pump of Eastern Industries, Inc. However, this is a gear pump and probably develops too much friction. We believe a piston pump or a ball-piston pump would have less friction.

A. A. DUKE
Paramount Laboratories
New Bremen, Ohio

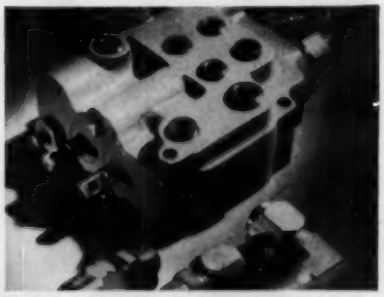
As an off-the-shelf item, the Eastern pump is the only one we know of which will meet your

Continued on page 61

O-ring leaks?

Heat failure was caused by a combination of compound and design problems. Parker field engineer was called. Leaks were stopped . . . and complaints ended.

Compare actual samples. Ask your Parker representative to check your specifications and design. Let him prove how Parker O-rings seal better, last longer.



What other Parker products interest you? *Triple-lok* flare tube fittings? Ferulok flareless fittings? *Hoze-lok* fittings? Hydraulic directional control valves?

. . . then call in your Parker field engineer for help

Having trouble with O-ring failures? Nibbled, worn, battered, leaking like a sieve? Whether your problem is in the basic design or compound, it's time to call a Parker representative.

Parker field engineers are trained trouble shooters. There is one in your area. From Parker you can get exactly the *right* O-ring and gland design for your *specific* application.

Compare Parker O-rings with any other make. You'll find that Parker O-rings are precision-molded of superior compounds. They have been developed as the result of years of experimentation to provide the proper elongation, tensile strength, compression set ratings, resistance to oils, fuels, chemicals, and high and low temperatures. Laboratory and service tests make sure that all rated characteristics are held.

Call your Parker representative for assistance. Mail the coupon for *free* technical bulletins about O-rings.

RUBBER PRODUCTS DIVISION
The Parker Appliance Company
17325 Euclid Ave., Cleveland 12, Ohio
1538 So. Eastern Ave., Los Angeles, Cal.

RUBBER PRODUCTS DIV.
Section 513-C
The Parker Appliance Co.
17325 Euclid Ave.
Cleveland 12, Ohio

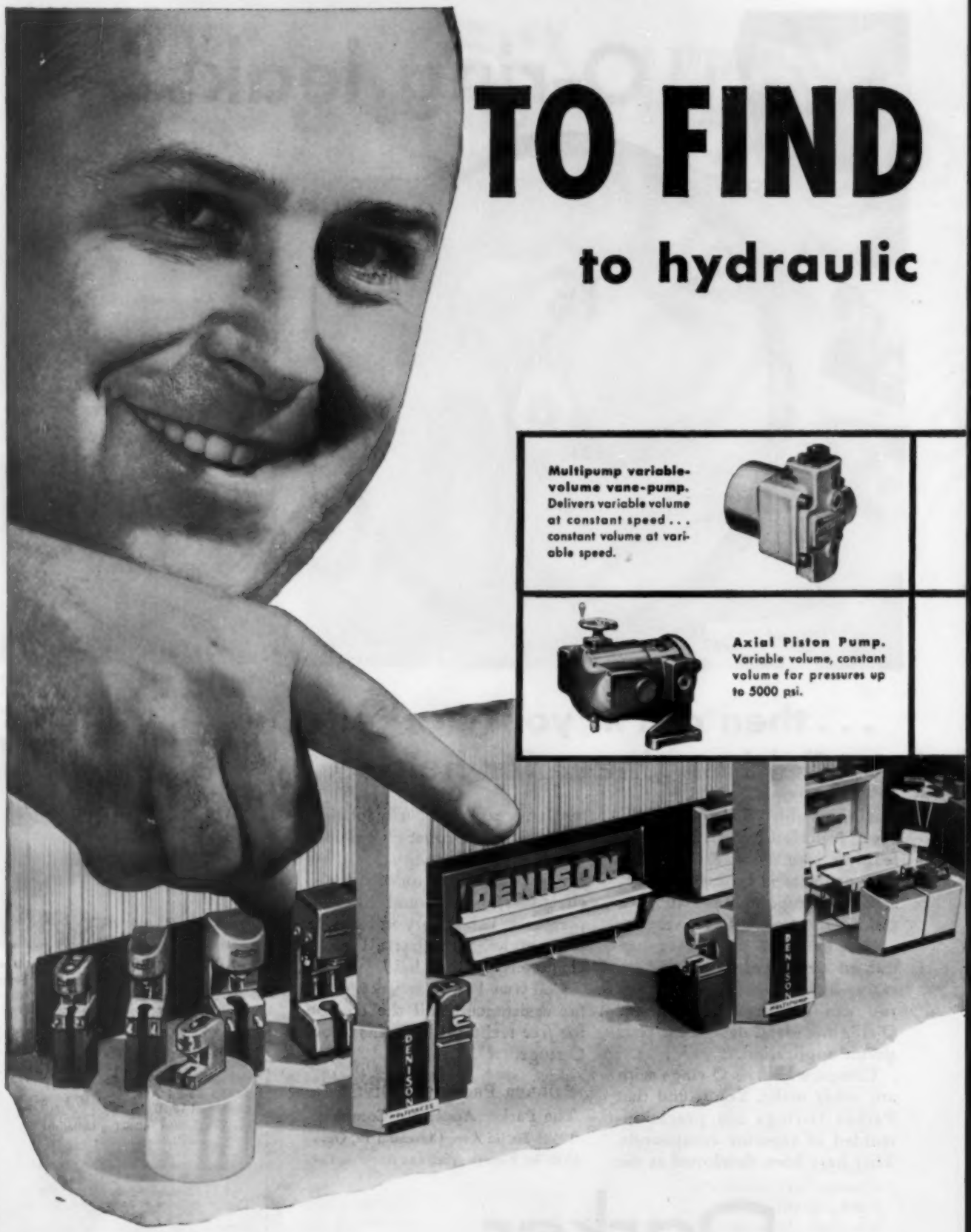
Please send the following bulletins:

- ☐ Silicone Rubber Bul. 5605 B1
- ☐ Materials for O-rings Bul. 5705 B1
- ☐ O-ring Operation Factors Bul. 5705 B2
- ☐ Thermal Properties Bul. 5705 B4
- ☐ Rotary Seal for High Speed Bul. 5705 B5
- ☐ Aircraft Hydraulic Packings Bul. 5712 B1

Name_____
Company_____
Address_____
City_____ State_____

Parker
Hydraulic and fluid system components

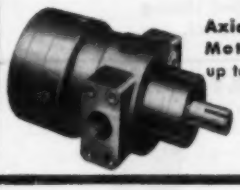
Circle 98 on Reader Service Card


TO FIND
to hydraulic
Multipump variable-volume vane-pump. Delivers variable volume at constant speed . . . constant volume at variable speed.
Axial Piston Pump. Variable volume, constant volume for pressures up to 5000 psi.
DENISON
DENISON
DENISON

THE ANSWERS

power–speed–control

VISIT US AT **BOOTH 819**



Axial Piston Fluid Motor for service up to 5000 psi.

Pressure Controls Relief, sequence, unloading, pressure reducing valves. Pilot-operated for circuits up to 5000 psi.

Multi-range Flow Control for full range regulation on variable speed circuits. For service up to 3000 psi.

Relief Valve. Pilot-operated for service up to 2000 psi.

Directional Control. 4-way pilot-operated, solenoid-controlled for service up to 3000 psi.

Pump-Motor. Vane-type, continuous duty to 2000 psi with bi-directional rotation.

WHAT'S YOUR PROBLEM?

Let Denison help you solve it . . . at Booth 819.

As a machine tool builder, Denison is privileged to demonstrate and display its entire line of precision hydraulic pumps, hydraulic motors and controls.

As a designer of machine tools and automatic machinery, you obtain data on Denison's latest developments in hydraulics . . . at the same time you witness a full line of Multipress in action.

While you are at our booth, one of Denison's hydraulic engineers will gladly suggest how to simplify your circuits, build greater dependability into your hydraulics . . . and cut costs of hydraulic equipment.

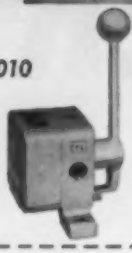
THE
DENISON ENGINEERING COMPANY
1166 DUBLIN ROAD — COLUMBUS 16, OHIO
Subsidiary of American Brake Shoe Company

DENISON Hydr OIL ics

Ledeen

PNEUMATIC AND HYDRAULIC EQUIPMENT

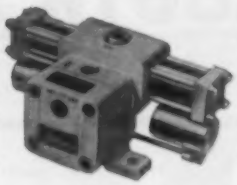
VALVES
bulletin 1010



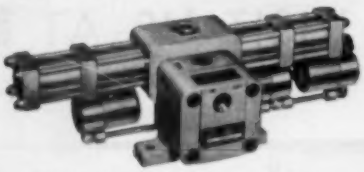
Hand Valves Manual or spring return to neutral or to reverse.

Foot Valves Single pedal spring return to reverse.

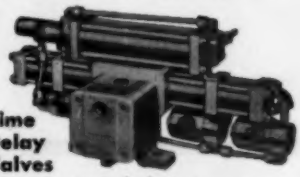
Foot Valves Double pedal foot or spring return to neutral.



Power Valves Two position, forward and reverse.

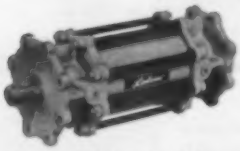


Power Valves Three position, forward, neutral and reverse.

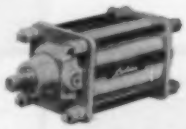


Time Delay Valves Power operated closing after delay interval.

CYLINDERS
bulletin 500



Heavy Duty Cylinders



Medium Duty Cylinders

Boosters

Special Cylinders

VALVE ACTUATORS
bulletin 3030

Gate Valve Actuators

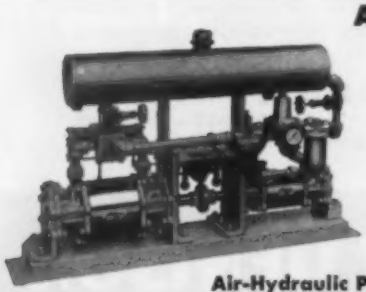
Diaphragm Valve Actuators

bulletin 3020

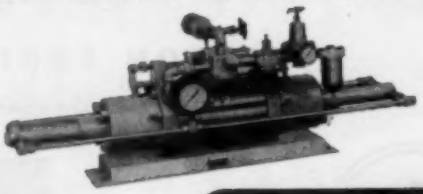
Plug Valve Actuators

Plug Valve Actuators

AIR HYDRAULIC PUMPS *bulletin 4000*



Air-Hydraulic Pumps Up to 1,000 psi oil from 100 psi air or gas.



Air-Hydraulic Pumps Up to 10,000 psi oil from 100 psi air or gas.

Ledeen Mfg. Co.
1610 So. San Pedro St.
Los Angeles 15, Cal.

Top quality—prompt delivery

LETTERS to the editor

small volume requirements. Although piston pumps, in general, have a higher efficiency than gear pumps, you may find the gear pump's efficiency high enough for your application. If a piston pump were available you also have a cost consideration—it's hard to beat a gear pump when it comes to price.

Pressure Snubbers

Do you know of any device which will prevent injury to a pressure gage when the pressure accidentally exceeds the maximum rated pressure of the gage?

R. P. WINTON
Norfolk and Western Railway Co.
Roanoke, Virginia

There are a number of manufacturers of gauge protectors. A list of suppliers has been sent to you.

Temperature Regulator

Could you advise a possible source for a water modulating flow valve controlling discharge volume by temperature measure for compressor jacket, inter-cooler, and after-cooler water control?

D. C. CARD
The C. S. Card Iron Works Co.
Denver, Colorado

There are several manufacturers who make a water flow valve which is thermally controlled to turn water flow on and off. This valve finds wide use in the control of water coolant on oil hydraulic systems, and can be used on your air compressor application. A list of manufacturers has been sent to you.

Hydraulic Motors

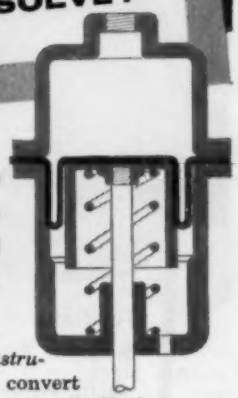
Can you tell us who makes hydraulic motors with built in gear reduction units in sizes from 7½ to 15 hp and final drives of approximately 125 rpm and working pressures up to 2000 psi.

M. F. KEMPER
Flocrete Manufacturing Co.
Los Angeles, Calif.

A list of manufacturers of 2000 psi fluid motors has been sent.

Continued on page 62

DO YOU HAVE A
PISTON SEAL PROBLEM
THAT Bellofram CAN SOLVE?



If your piston seal problem involves low friction losses, no leakage, high working pressures, resistance to corrosion, vibration fatigue and damage . . . Bellofram is the answer.

Bellofram—the long stroke, deep convolution constant area diaphragm which performs both bellows and diaphragm functions — offers the designer and manufacturer some *19* specific advantages as a piston seal for use in pressure sealed mechanisms. Free positioning with complete relaxation at all points within its designed stroke, the Bellofram has valuable application in *instruments* — to convert pressure into force or displacement with extreme accuracy; in *power actuators* and *motors* — to convert pressure into a long stroke at high thrust levels without mechanical friction; and as *seals* — to prevent leakage of liquid or gas across a moving piston without introducing friction or spring gradient.

CLASS 1 FLANGELESS BEAD TYPE
CLASS 2 FLANGE TYPE NARROW CONVOLUTION
CLASS 3 BEADED-FLANGE TYPE
CLASS 4 FLANGE TYPE WIDE CONVOLUTION

Bellofram Seals are manufactured in four distinct classes, to meet the needs of a broad range of pressure sealed mechanisms. Over 300 standard sizes are available, for cylinder bores from 1" to 6". You also have a choice of numerous elastomer-fabric combinations, ranging from Nitrile Rubber and Nylon to Silicone Rubber and Dacron. This tremendous variety permits selection of the most *effective* Bellofram Seal for *your* application. Contact Bellofram now, for complete information on the benefits offered you by Bellofram Seals.

Competent Engineering Counsel Available.
Write for new Bellofram Catalog containing Specifications, Descriptions and Application Data.

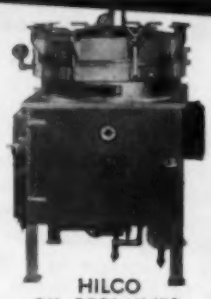
Bellofram®
CORPORATION
140 MOODY ST., WALTHAM 54, MASS.

Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
- No More Flushing and Manual Cleaning
- No More Frequent Oil Changes
- No More Accumulation of Dirt

Filter life up to a year eliminates usual frequent draining, refilling of systems.

HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.



HILCO
OIL RECLAIMER

For complete oil reclaiming. Removes solids, acids and volatile impurities; moisture, solvents, gasses, etc., from hydraulic fluids by heat-vacuum process.

• SEE FOR YOURSELF HOW HILCO keeps your Hydraulic System Clean . .

WRITE TODAY FOR THIS *Free* BOOKLET

Recommendations at no Obligation

THE HILLIARD Corporation

148 W. FOURTH ST. • ELMIRA, NEW YORK

IN CANADA:

LETTERS to the editor

Gear reduction built into the motor housing is not standard. The gear reduction unit is normally coupled to the motor shaft. Several manufacturers supply the complete package.

Wants Hydraulic Winch

Who manufactures a hydraulically actuated winch complete with a 4-way valve. The winch should be of 1000 pound capacity, carrying 1000 feet of ¼ inch wire rope and be light in weight.

ROSS E. ANDERSON, JR.
Halliburton Oil Well Cementing Co.

To our knowledge no company makes a standard hydraulically operated winch in the size you want. We suggest that you contact the group of companies who make winches to learn if it is practical for them to adapt a unit to your requirements.

"Fluid Power Circuits"

Can we obtain the "Fluid Power Circuits" which was published in January 1954.

GEORGE DEBROCK
Color Carousel Corp.

Over 10,000 reprints of the 32 page section have been sold. Our supply has been exhausted. There is a section of circuits in THE MASTER CATALOG OF FLUID POWER PRODUCTS *which will be out next month.*

AN Fittings

We would like information on sources for AN fittings and AND 100050 annealed stainless steel tubing to cover specifications MILT 8504. Can you give us a source of AN-919-3 which is to fit a ¼" OD x .035" wall stainless steel annealed tubing—also a source for this tubing?

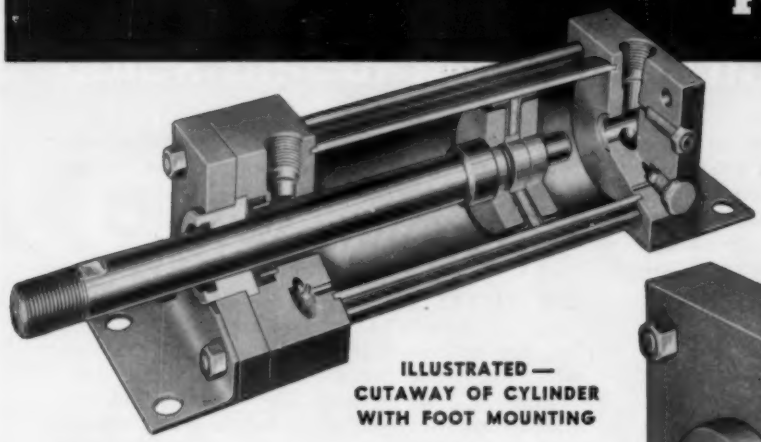
W. J. CALLAGHAN
Stupakoff Division,
The Carborundum Company

A list of fitting and tubing suppliers has been sent.

FOR TOP EFFICIENCY . . . *Logan Air and Hydraulic Equipment On Your Product . . . In Your Plant*

LOGANSQUARE CYLINDERS

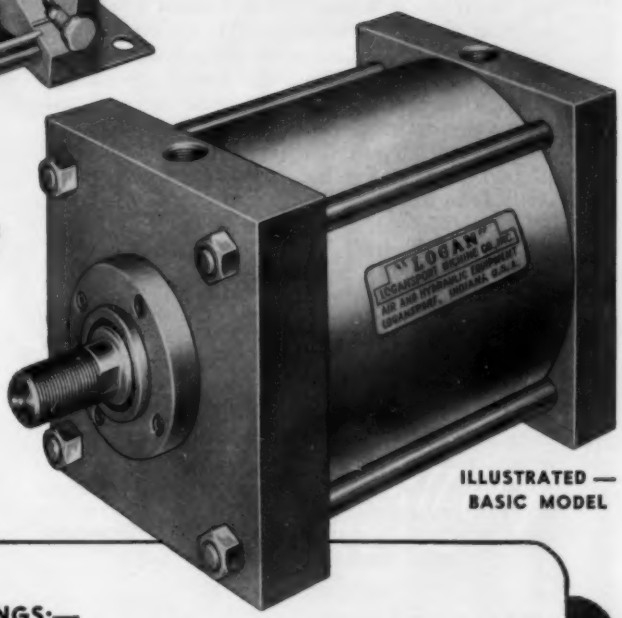
FOR AIR OR OIL



ILLUSTRATED—
CUTAWAY OF CYLINDER
WITH FOOT MOUNTING

NOTE—Compact, Rugged Construction . . .

Designed for easy mounting



ILLUSTRATED —
BASIC MODEL

LOGANSQUARE CYLINDERS

STANDARD BORE SIZES:—

1½" to 8"

MAXIMUM STROKES:—

Up to 5 feet 150 psi Air
Up to 8 feet 80 psi Air
Up to 3 feet 500 psi Oil (nonshock)
Up to 5 feet 250 psi Oil (nonshock)

MOUNTINGS:—

Full range of mountings and mounting combinations to meet practically any requirement.
Tie Rod—Blind End, Rod End, Both Ends
Foot
Trunnion—Blind End, Rod End
Centerline
Flange—Blind End, Rod End
Pivot—Bolted Clevis, Welded Clevis
Rod—Single or Double End
Rod end has male threaded extension. Other size male threads and female tapped ends available to customer's specifications.

Write for Logansquare Catalog 100-5

MEMBER—
National Tool Builders Assn., National Fluid Power Assn.

LOGAN MANUFACTURES 7023 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

SAVES TIME
Logan
AIR AND HYDRAULIC EQUIPMENT
EFFORT-MOTION

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3 • AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 HYDRAULIC CONTROL VALVES, Cat. 200-4 • HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62.

LOGANSPORT MACHINE CO., INC., 832 CENTER AVE., LOGANSPORT, IND.

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

ACCUMULATOR . . . to absorb shock and vibration in lift trucks is described in Bulletin 1100 available from Greer Hydraulics, Inc. The bulletin shows a pictorial schematic of the accumulator installed in the hydraulic system, and illustrates several applications. An illustration of how the unit works is given with a cut-away drawing showing oil compartment, gas compartment, air valve, poppet valve, drain plug, and oil port. The accumulator is easily installed and is available in many standard sizes for pressures up to 6000 psi.

Circle 226 on Reader Service Card

HOSE AND FITTINGS . . . manufactured by American Coupling Corp. are detailed in a catalog available from the company. The information lists low-pressure hose with ID ranging from 3/16 to ½ inch, medium pressure hose from ¼ to 1-inch ID and high pressure hose from ¼ to 1-inch ID. The pressure limits of these types are 500, 1250, and 5000 psi respectively. Six types of fittings are shown and are available in permanent or re-usable construction. Steps in attaching re-usable couplings are illustrated.

Circle 227 on Reader Service Card

HYDRAULIC PUMPS . . . are the subject of 12-page Bulletin H3A1 prepared by Webster Electric. The bulletin details positive displacement gear pumps and motors with capacities ranging from 1/5 to 30 gpm and pressures up to 1500 psi. Dimensional drawings and tables of performance specifications for each type pump are included. The tables indicate displacements, horsepower requirements, and deliveries at various speeds. Integral motor pump units are specified with data on deliveries, maximum pressures, motor horsepower, and dimensions.

Circle 228 on Reader Service Card

HYDRAULIC TEST STANDS . . . with controlled temperatures are reviewed in Catalog No. 5-H prepared by American Research Corp. The catalog includes five types of stands including models for high pressure, high volume fuel pumps, and for calibration of aircraft carburetors. A servo flow stand was developed and specially engineered to analyze regulating and metering devices under a wide range of fuel and oil temperature and pressure conditions. The basic hydraulic test stand is a standard unit designed to meet a wide range of test requirements. It is for pressures up to 3000 psi and flows to 6 gpm. The high pressure test stand is for pressures up to 5000 psi and flows to 100 gpm. It has a mounting pad for driving pumps at variable speeds up to 4000 rpm in either direction.

Circle 229 on Reader Service Card

AIR FILTERS . . . with a centrifugal action are the subject of Bulletin 117 released by R. P. Adams Co., Inc. The bulletin illustrates the action of the filter which has an inlet nozzle to direct the air in a whirling motion inside the body. Water, dust, oil and pipe scale are thrown by centrifugal force against the inner wall of the filter and are trapped in the slots which drain to the bottom. Second stage separation is by diffusion through a permanent element which is unaffected by oil or moisture. A chart is included to aid in selecting the proper filter and to give price information.

Circle 230 on Reader Service Card

SELF-FLARING FITTING . . . incorporating an internal wedge is described in Catalog No. BA 555 issued by Flodar Corp. The fitting makes a perfect joint because tubing is internally supported by the wedge insert against which the flare is made as the nut is tightened. The catalog illustrates the action of the fitting and describes the function of each part. The unit permits repeated assembly and disassembly, because each time the fitting is assembled, the nut comes to a positive stop. Because the unit prevents connecting tubing to a fitting unless the end of the tubing is free from collapsed walls or inside burrs, it guarantees full, unrestricted flow.

Circle 231 on Reader Service Card

VALVES . . . for air and oil service are detailed in Folder No. 14 available from Versa Products Co., Inc. The valves are manufactured in four basic body types each for manifold mounting or with threaded side ports. Each is available in six sizes from ⅛ through 1 inch NPT, and each is adaptable to any two of more than twenty standard actuating devices to meet nearly every requirement in the low pressure and intermediate pressure valve field. Actuating devices applicable to the valves include hand, cam, foot, pilot, solenoid, and differential pilot devices. The differential pilot device can be installed on both ends of the valve to provide a bleed-type valve. This valve can be offset by momentarily bleeding one pilot, then the other through two small-orifice, two-way valves.

Circle 232 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 140

*Snap-Tite

QUICK-CONNECT

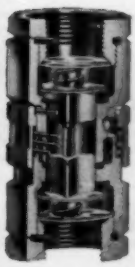
QUICK-DISCONNECT COUPLINGS

in larger sizes

immediate delivery
FROM FACTORY STOCKS

SNAP-TITE'S "H" COUPLING: SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

Snap-Tite's "H" Couplings are now factory-stocked for quick shipment to you, not only in the smaller sizes (below 1" ID) but in all sizes up to and including 3"—in steel, brass, aluminum, and 303 and 316 Stainless Steel. And "H" Couplings can be made to your order, up to 10" ID.



Available with valves to give two-way or one-way automatic line shut-off, or without valves for straight-thru flow, "H" Couplings are built to handle high pressures in hydraulic and air systems.

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—allow maximum flow capacity with lowest pressure drop.

See the Snap-Tite representative in your city or write for Bulletin 240.

*Snap-Tite, INC.

UNION CITY 1, PENNSYLVANIA

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

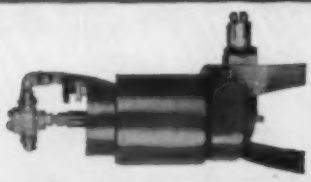
ELECTRONICALLY CONTROLLED hydraulic power FOR AUTOMATION

When Champlain Company, Inc., developed their amazing REGISTRON for *automatic* color register control on rotary presses, they needed a fluid motor that was *precise*. After exhaustive testing of many types, only Eastern Fluid Motors met their high standard for performance.

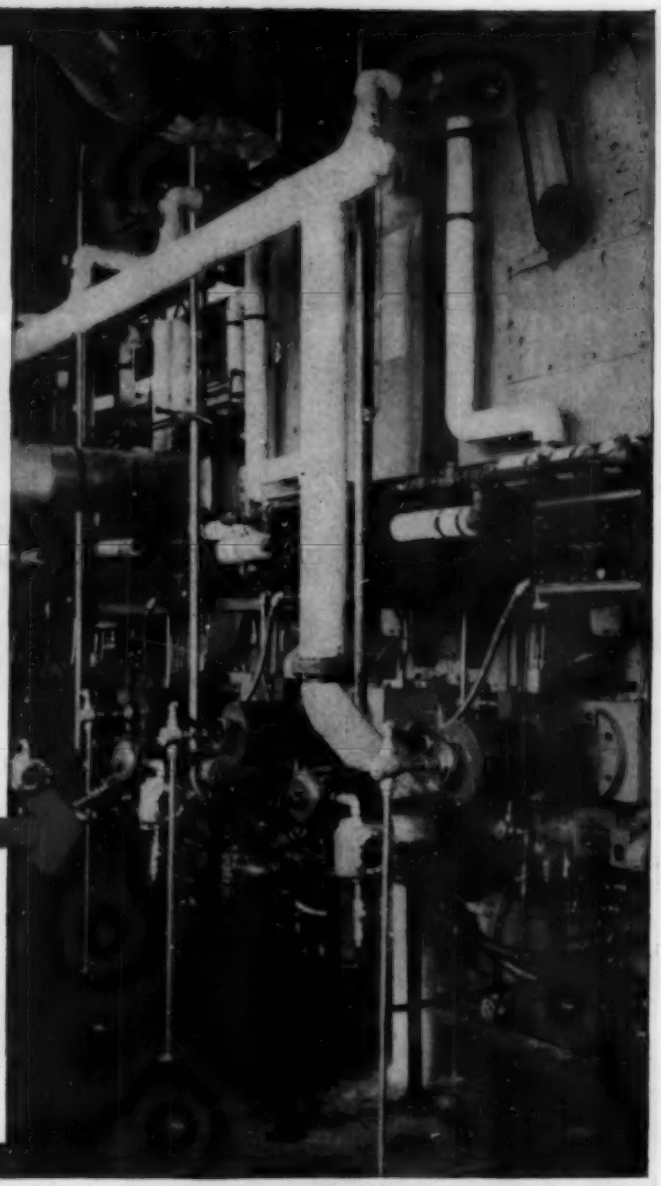
Eastern Fluid Motors are lighter, more compact, and give rapid response because small components give low inertia loads. They quickly transform electronic signals into smooth flowing, precise hydraulic power.

Registrons are installed on high-speed rotary presses that simultaneously print as many as eight colors on a web of paper that travels at speeds up to 1500 feet per minute. Each color must be perfectly registered to tolerance of .0025" or printing appears fuzzy. The Champlain Registron inspects the moving web and the rotating printing cylinder, predicts the occurrence and direction of an off-register condition, and starts and completes a correction quickly.

Eastern is proud to have a part in Champlain's Registron which has developed *automation* in answer to printing's toughest problem.

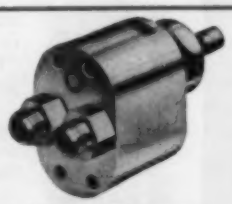


Close up of a phase detector with Eastern Fluid Motor atop it. The fluid motor supplies instant power to move the printing cylinder and correct off-registration within a tolerance of .0025".



Rear view of 8-color, 36" rotogravure press showing individual Registron control units cable-connected to their respective phase detectors. A second cable carries impulses to the units from each web scanner.

HYDRAULIC PUMPS



FLUID MOTORS

AIRCRAFT-TYPE PUMPS

If your application calls for precision hydraulic equipment that performs within strict tolerances, Eastern equipment may provide your best answer. For helpful operating data on fluid motors, hydraulic pumps, and aircraft-type pumps, request catalog series 31.

Eastern

INDUSTRIES, INC.

100 SKIFF ST., HAMDEN 14, CONN.

Five years ago, on the occasion of our twentieth anniversary in business, we ran the following editorial. It is just as true today as it was then. Changing the figure "20" to "25" gives you our story today EXCEPT that we have enjoyed five more years of building, five more years of health, five more years of God's blessings—for all of which we are truly thankful. We'll do our utmost in the next five years to maintain your respect and confidence.

25 years

The fact that our company is 25 years old this month is relatively unimportant to anyone except ourselves. Thousands upon thousands of other companies have become 25 years old, and much older. But to us, the important thing is the way in which this company started, and the way it has progressed these 25 years. Because only in America could this story have been written.

This company started on the ashes of a depression failure. Our first magazine, INDUSTRY AND WELDING, had 24 pages in each issue, of which 3, 4, 5, or 6 were advertising. At 3, 4, or 5 pages, we couldn't pay our printer, but with 6 we could just make it. Whether there were 3, 4, 5, or 6 pages of advertising at no time removed the personal necessity of eating, dressing, and traveling to get the 7th, 8th, and 9th page of advertising. Somehow, we muddled through. In America, you can do those things—with pride.

Many were the times when it looked as though we couldn't make it, and always, when it looked blackest, some miracle would happen and we'd be in business—for another month at least. We stuck. Friends were good to us. People had faith in what we were doing. You find that Americans like to help other Americans who are trying to help themselves. It is the essence of our country, of free enterprise.

No government questioned our right to be in business. No bureau told us what to print or how it should be said. We were free to make whatever profit we could manage and reinvest it in our own business or in any other way we saw fit. That, too, is the American way.

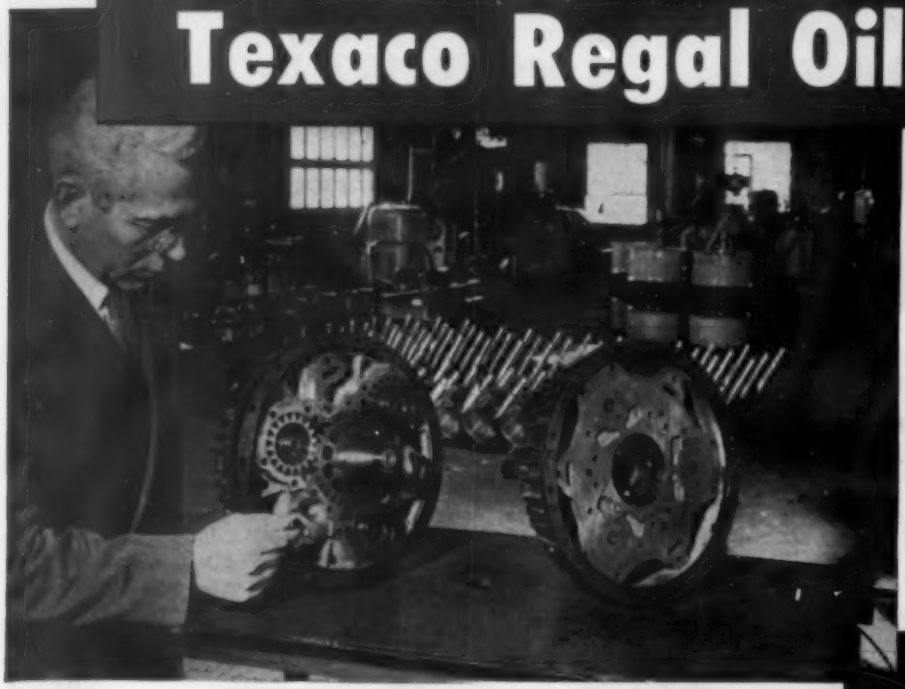
We chose to start magazines in other fields. No one told us what fields to start in or whether we could go into them. As long as we were willing to work and take the beating that every new, small business must take, we were permitted to build our own business in our own way.

These 25 years have been gratifying ones. It has been fun building a business. There's been a lot of hard work, long hours, and various worries, but we're glad we're in the publishing business, because we feel that we have contributed something to industry and to the general welfare of our country. We shall continue to do so. But again we say, ONLY IN AMERICA COULD THIS STORY HAVE BEEN WRITTEN. It is one of our greatest heritages which, unfortunately, we take for granted, and it's one worth keeping and worth fighting for.

Irving B. Hexter

Irving B. Hexter, President and Publisher

"Here's why we factory-fill our VariDRAULIC drives with Texaco Regal Oil R&O"



—says John Thomas, Chief Engineer, Thomas Hydraulic Speed Controls, Inc. Wichita, Kansas

"This disassembled Model SRA VariDRAULIC Drive," explains Mr. Thomas, "was installed on a wheat harvesting combine in 1949. After five years' use, harvesting wheat from Texas to North Dakota, the operator reported that the drive had never been opened, had never given a moment's trouble, and no oil had ever been added. We asked the operator to return it.

"Inspection revealed the excellent condition of the VariDRAULIC Drive and the *Texaco Regal Oil R&O*. All components looked just like new and unused parts. And the *Texaco Regal Oil R&O* itself—which had never been changed or added to—was clean and clear, despite the fact that the drive operated at times in excess of 210 degrees F., and the oil capacity of this drive is only seven quarts."

Hydraulic manufacturers and operators everywhere report similar fine results with *Texaco Regal Oil R&O*. This is the oil that tests prove has *more than ten times the oxidation-resistance* of ordinary turbine-quality oils—far superior ability to keep systems free from sludge, rust, foam and wear.

There is a complete line of *Texaco Regal Oils R&O*, approved by leading hydraulic manufacturers for all types of hydraulic equipment. A Texaco Lubrication Engineer will gladly help you select the proper one. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THOMAS VariDRAULIC Drives, every one factory-filled with *Texaco Regal Oil R&O*, are also giving noteworthy performance as the variable speed link between power source and work load in heavy-duty farm machinery, industrial construction and oil field equipment.

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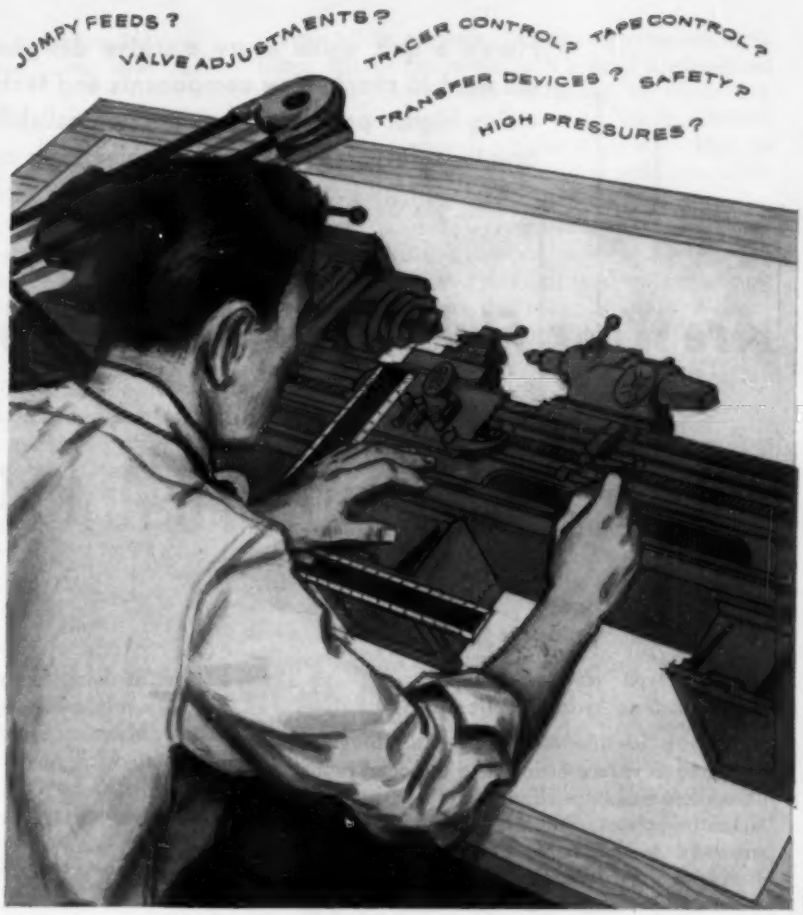


FLUID POWERED MACHINE TOOLS

SEPTEMBER is THE machine tool month. Chicago is expecting at least 100,000 visitors to the three expositions at which machine tool, metalworking equipment and components will be shown by more than 500 manufacturers.

In the Briefs columns of this issue, which you've seen before you got to this page, there are short descriptions of many of the machine tools on exhibit which use air or oil power.

These machines represent applications of fluid power which have proven extremely reliable. We doubt if any of the circuits are new, novel or untried. They are circuits which you as a designer or user should be fully familiar with. To you, pneumatics and hydraulics are a power source which helps to produce parts, having quality machined finishes, at greater speeds with less effort than ever before.

Articles in this issue emphasize circuit ideas, design methods and applications which put fluid power to work on machine tools.

Here's a quiz which every machine designer and machine tool owner will want to check. New components and techniques in assembly are providing higher performance, increased reliability, lower maintenance and greater safety. How do your machine tools compare with this check-list?

Are Your Fluid Powered Machine Tools UP-TO-DATE?

● *Have you eliminated piping and threads in hydraulic circuits?* Yes ☐ No ☐

Modern machine tools are using tubing and flexible hose to reduce fittings and threaded joints. New threadless subplates eliminate tapped holes in valve mounting plates. Both flared and flareless fittings are used so that the sealing is not dependent entirely on a threaded joint. Bolted flange type and welded connections are fast replacing pipe and threads for line sizes greater than 1½ inch. The ultimate goal is the complete elimination of threads.

● *Do most of your machine tools have valve panels?* ☐ ☐

The days of mounting valves in a line without any support other than the threaded connections have just about past. Panels put valves where they are accessible and reduce leakage because of rigid mounting. In-line valves usually develop leaks because of vibration. A further step in modernizing your machine is the use of a manifold which includes many of the interconnecting passages. These manifolds, which may be a drilled type or a sandwich type or welded, increase machine reliability by reducing possible leakage points. Machine tool builders are using manifolds more than other builders because their machines usually have a firmly established circuit and operate at pressures below 1000 psi.

● *Are your fluid lines safe from damage and yet accessible for repair?* ☐ ☐

There are three possible locations for lines. If you run them overhead you might not be able to get at them. If you run them around the machine they might be damaged by a careless operator or by material handling equipment. If the piping is carried inside the machine, it may be inaccessible and leaks may not be discovered until they are very bad. Final layout of piping requires a compromise which depends on the type of machine and where it will be used.

● *Are there pressure gauge connection points on your machine?* ☐ ☐

This is a desirable feature. How far you can go in supplying check points becomes a matter of cost. The user wants them but he may not be willing to pay for them. However, only one or two check points may be enough to trouble shoot a circuit.

● *Is oil from the hydraulic tank being used to lubricate machine ways and slides?* ☐ ☐

Don't do it. It's not a good idea and besides if the customer insists on adherence to J.I.C. standards you may not be able to sell the machine. The standards indicate that if operation is infrequent and pressure is low, and there is some means of eliminating contamination, combining both functions might be acceptable. Of course, one fluid would have to be able to perform both jobs if there is to be any success.

● *Can a repairman find and identify the hydraulic valves on your machine?* ☐ ☐

Too few machine builders do much about this. Panel mounting helps a lot because no valves are

hidden and "lost". Numbering of valves to correspond with valve numbers on a circuit drawing would help.

● *Are you taking advantage of recent developments in components for 2000 to 5000 psi?* ☐ ☐

Most machine tools are operating at pressure under 1000 psi because most designers and users think they would only add to their leakage problems by going to higher pressures. Builders of machines which require a fine feed get better control with low pressures and large volumes. There is, of course, no sense in going to high pressures unless there is something to be gained. High pressure components which are being widely used on fabricating machines are available to the machine tool builder who has a design on which high pressure will help. Machine drives using fluid motors appear to be the place for high pressures on machine tools.

● *Is replacement of cylinder rod end packings difficult and costly?* ☐ ☐

This is a real problem when replacement is frequent. And on high production machines even infrequent breakdown due to normal seal wear can be very costly in machine downtime charges. If this is a problem to you, recently developed air and oil cylinders having cartridge type rod packings should be used. These cartridges can quickly be removed and replaced.

● *Do you have cylinders which are cast integral with the machine?* ☐ ☐

If you do, can they be serviced? While integral cylinders are being frowned upon, the designer who can still make it possible for quick and easy service of rod and piston packings can use them advantageously. If the customer is going to have a maintenance headache, you'll have a tough time selling any other advantages that the integral cylinder may have.

● *Can pressure and flow adjustments be easily made?* ☐ ☐

On many machines, adjustment is too easy. Everybody can turn a handle. One effective answer is a locked cabinet. This permits easy adjustment only when it is desired.

● *Have you used fluid motors for machine spindle drives?* ☐ ☐

A number of machines—shell lathes, grinders, honing machines—are using fluid power to drive the spindle. These spindle drives are constant horsepower units—high torque at low speeds—low torque at high speeds. A variable displacement motor will provide this constant horsepower characteristic. When driving the motor with a fixed displacement pump, the speed range is limited to about 4:1. However, using a pump and motor which are both variable displacement permits a ratio as high as 50:1. Some machines are operating with even much higher speed ratios.

Using variable delivery units pretty much limits the job to expensive piston type units. Some builders are getting around this cost problem and accepting some limitations by using constant delivery vane motors. Torque increase is obtained with pick off gears.

● *Do you use "O" rings to seal rotary or reciprocating motion?* ☐ ☐

"O" rings aren't being limited to static sealing applications. A number of machine tool builders are using them to seal reciprocating pistons. Many of these jobs are proving that the "O" ring will give satisfactory life. These applications are on machine tools operating at pressures under 500 psi. Surface finish and gland design are critical.

● *Is there a suction filter in the tank?* ☐ ☐

This might be as bad as it is good. We've got to assume that the filter is the right size and that it can be serviced easily. If that's the case, having a suction filter is good. But if you stand a chance of starving the pump due to a plugged or too small suction filter you better do some redesigning.

● *Are all the solenoid covers still on your machine after it has been in use for six months?* ☐ ☐

New solenoid valves, both air and oil are being made so that the valve is inoperative when the cover is removed. Valves are being made so that they can be operated manually without removing the cover. On valves which will operate with the covers off, chaining the cover to the valve body reduces the number of lost covers.

● *Are servo controlled pumps used on any of your machines?* ☐ ☐

Hydraulic servos have advantages because of the basic characteristics of fluids. Low inertia of the moving parts of the hydraulic devices allow high acceleration, quick stops and small time constants. You can operate under stalled torque conditions and radical speed changes without damage. A high ratio of force to inertia can be developed and a large amount of power can be handled by a small package. You can adapt the pump to electrical control to provide remote operation. large power amplification and flexibility of feed back methods. ▼▼▼

TAPE CONTROLLED machine consists of a standard four-spindle precision boring machine modified with built-in electrical controls, tape "reader" and manual controls housed in a control cabinet at the left. In the foreground an operator uses a perforating machine, similar to a typewriter, to punch hole coordinates.

There's a PUNCHED TAPE in YOUR Future

FEED cylinders on machine tools are being controlled by signals from a punched tape. Even if you have a small shop where a run of 500 parts between setups is big, punched tape control will be practical.

Production models which are still on an experimental basis look very promising. Minneapolis-Honeywell Regulator Company has set up a Machine Control Group. Their objective is to design and build devices for feeding instructions to standard and special machinery and machine tools.

• **Boring machine**—Their first development is a punched tape electronic control system that converts a precision boring machine to automatic operation. Designed for the company's own use, the machine turns out precise gear trains for aeronautical controls.

Hole coordinates and feed instructions are punched on the tape by a perforating machine similar to a typewriter. Electronic signals from the tape regulate the linear travel of the boring machine's hydraulic cross-slide and the rotary motion of a specially designed holding fixture mounted on the cross-slide.

• **Machine set up**—Tape preparation requires approximately five minutes per hole and complete changeover from one part to another can be accomplished in about 30 minutes. To set up automatic operation, the proper adapter ring is attached to the rotary fixture, cutting tools are mounted in the four spindles of the boring machine and the punched tape is placed in the reader of the control circuit. After inserting a blank piece in the fixture, the operator merely presses a button to initiate the automatic tape controlled cycle. After the machine has "read" the complete strip of tape, it automatically

stops to permit removal of the finished part.

• **Flexibility**—Designed for boring shaft holes in gear plates in which the center-to-center hole tolerances must be tight to prevent binding or backlash, the machine is adaptable to a variety of hole patterns and sizes.

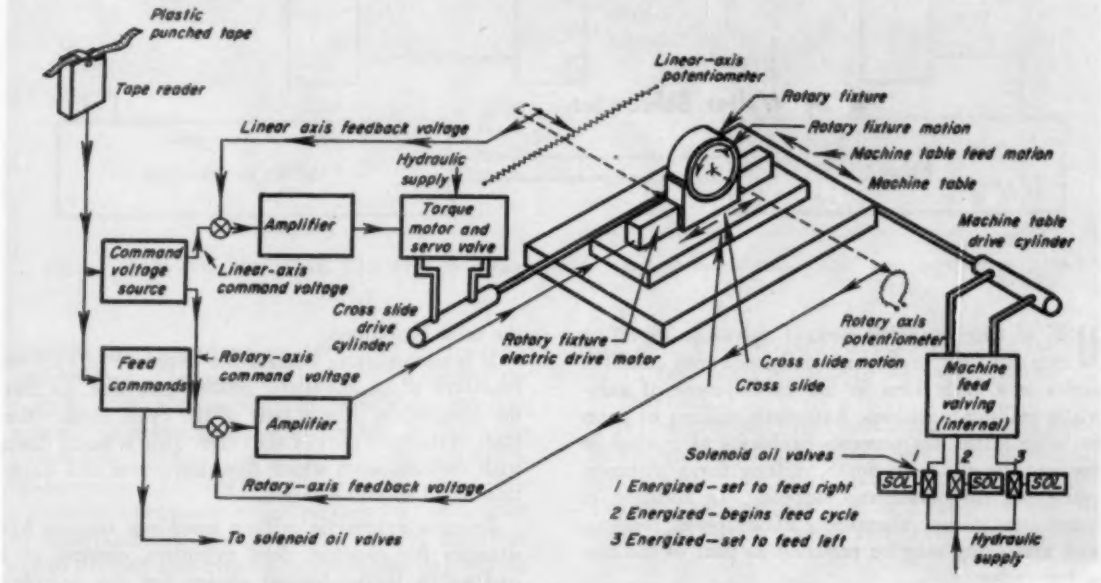
Different piece parts can be handled merely by changing the adapter ring and inserting the appropriate tape. Where a small number of special plates is needed, the machine can be manually operated by adjusting 10 knobs to control linear travel of the cross-slide and rotary motion of the holding fixture.

The flexibility of the tape controlled boring machine offers an ideal solution to the problem of production of medium-sized lots—about 500 parts.

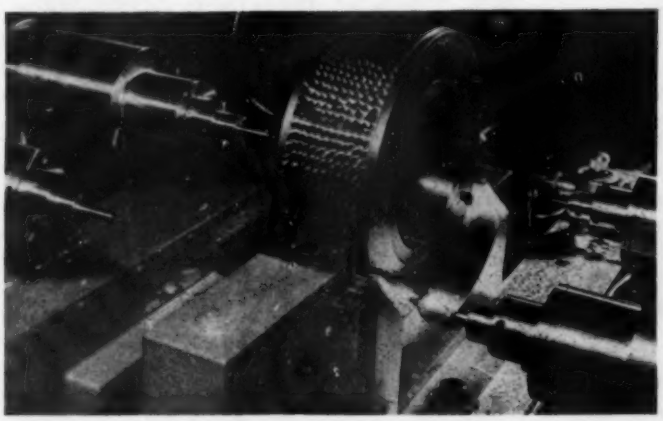
• **Response Time**—The time required to machine a hole is essentially unchanged with tape control. After the part is positioned (about 5 seconds per hole) the basic machine feed cycle is initiated. The feed cycle then takes place as directed by the basic machine controls. After the feed cycle, the tape control system again takes command and positions the part for the next hole to be machined.

• **Cost**—The tape control system was designed and built on an experimental basis; the actual cost of this first system is not a true indication of the cost of a second system. The cost of a tape control system for a boring machine of this type is probably somewhat lower than the cost of the basic machine.

• **Accuracy**—In either manual or tape controlled operation, coordinate information is fed to the machine in increments of .0001 inch over the eight inch linear range and .01 degrees over the 360 degree rotary range. Accuracy is better than plus or minus .005 inches. ▼▼▼



LOW PRESSURE HYDRAULICS, 125 psi, powers the cross-slide and machine table cylinders. An 8 gpm pump does the job. Table cylinder has a 3 inch bore and 12 inch stroke. Cross-slide is moved by a 2½ inch bore, 10 inch stroke cylinder. The machine table feed valving is not modified by the control circuit. The torque motor and servo valve in the cross-slide circuit are part of the new development.



PLASTIC TAPE sends out electrical impulses to regulate the linear travel of the machine's hydraulic cross-slide (lower left) and the rotary motion of the holding fixture mounted on the cross-slide. To set up automatic operation, the proper adapter ring is attached to the rotary fixture; cutting tools are mounted in the four spindles; the tape is placed in the "reader". After the complete tape has been "read", the machine automatically stops to permit removal of the finished part.

Here's a control technique which has proved successful during years of rugged service on milling machines. A purchaser of an automatic mill wants flexibility so that he can easily and quickly change the cycle to produce many different parts. Designers of milling machines provide flexibility by getting . . .

SEQUENTIAL CONTROL *from a cam shaft*

● By Walter Schroeder

USE of cam operated control valves to direct or stop oil flow to hydraulically powered machine slides is a basic idea in the development of automatic milling machines. Automatic milling of parts in large quantiites presents problems of control in feeding the cutter to depth, milling for a distance, retracting the cutter and stopping. In addition to these operations, clamping, unclamping, loading, and unloading may be required as part of the machine cycle.

Cam shaft control is an answer to proper sequencing of milling machine operations. Milling machines using the cam shaft control are now automatically producing parts for sewing machines, business machines, electrical apparatus and fire arms.

The development of the automatic milling machine eliminates the repetitious and monotonous manual control by the operator and substitutes an automatic control of equal or greater reliability and speed. For many jobs, a conventional hydraulic circuit which provides automatic rapid approach, feed, reverse and stop is not enough. The signalling of these events in a cycle requires movement of the table in order to trip the various control plungers. Nothing can be done while the table is stopped. On many jobs certain phases of the cycle must be performed while the table is stopped.

It is necessary to control the sequence of various functions of an automatic milling machine, so that the completion of any part of the cycle signals the start of the next part of the cycle. This is being done with the cam shaft which fixes sequences and duration of all machine events.

Because automatic milling machines require hydraulics for clutches, feed cylinders, clamps, etc., hydraulics is the logical choice for the complex signalling job in controlling the cycle. On single purpose machines where changes in the cycle are not required, sequence valves can be used. Another simple hydraulic control uses a machine element to actuate a control valve which in turn controls the operating cylinder or motor. A refinement of this method incorporates a pilot valve to control the operating valve. These circuits are limited in that the operation cannot include any stops of the machine in the cycle, because there is no way of starting again.

The cycle cam arrangement in which a cam shaft is rotated hydraulically and actuates control valves permits great flexibility in machine cycle. The function of the cycle cam is shown in Figure 1. Dogs on the moving machine elements actuate the trip valves at preset positions of the machine elements. The trip valves actuate the operating plungers which rotate the cycle cam. The cycle cam

WALTER SCHROEDER, *Project Engineer, The Cincinnati Milling Machine Co., Cincinnati, Ohio*

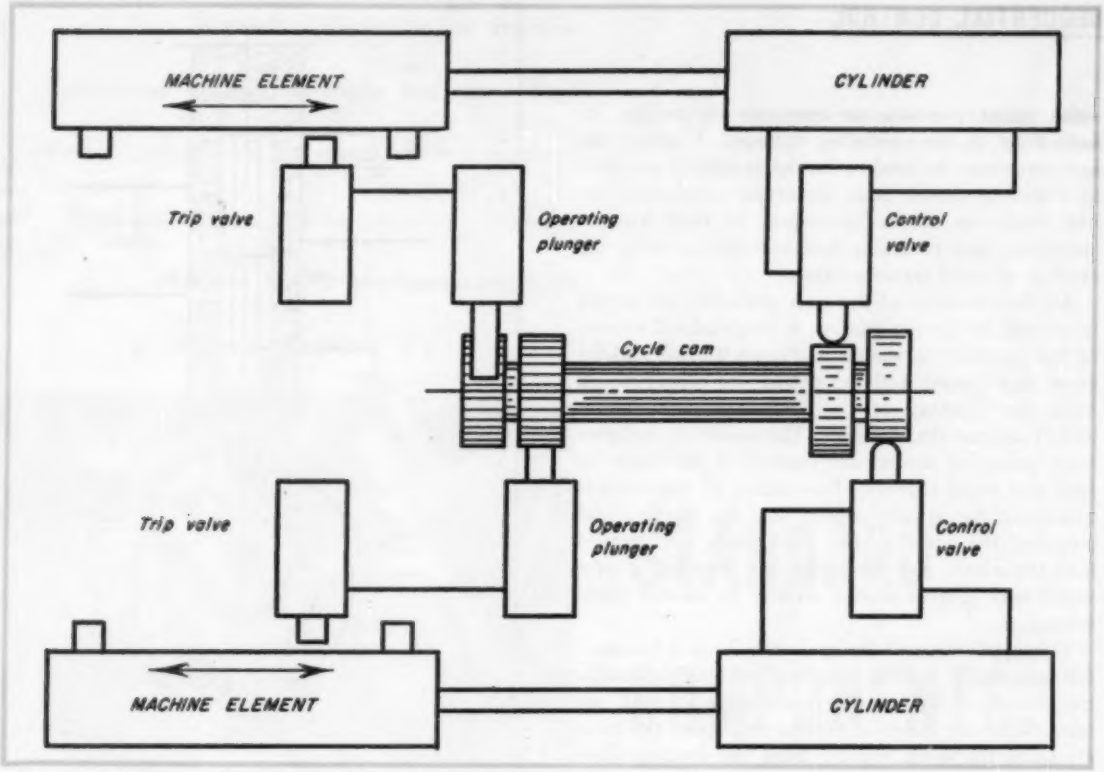


FIG. 1. MOVING MACHINE ELEMENTS actuate cycle cam through trip valve and operating plunger.

actuates the control valves according to the cam arrangement. The control valves in turn control the cylinders which operate the machine elements. Any number of operating units within one machine can be combined to function in a cyclic sequence which is determined only by the shape of the cams. The number of operations is limited only by the number of cam positions. The necessary control functions are so divided that every adjustable trip dog signals the instant and position of the machine when one event ceases and the next one starts. The type of event, however, is called for on the exchangeable cycle cam which need not be moving continuously. This division of control permits the greatest variety of jobs on the same machine.

TRIP VALVE OPERATION

Figure 2 shows the arrangement of the trip valve and operating plunger. The trip valve is a 3-way, 2-position, spring-loaded valve which controls oil flow to the operating plunger. In the normal up-position, the valve pressure port is closed and the drain port is connected to the plunger. When the trip valve is actuated, flow is to the plunger. The operating plunger moves down, and the pawl rotates the cam shaft one index position. When the trip valve is released, the spring-loaded operating plunger returns to its original position. The stroke of the operating plunger is fixed and rotates the cam shaft a maximum of about 28 degrees for each of 13 cam positions. Up to 24 cam positions can be provided.

The control valve and cam arrangement is shown in Figure 3. The valve has three positions and is spring loaded to stay in contact with the cycle cam. The two extreme positions are for reversing the connected cylinder while the center position pro-

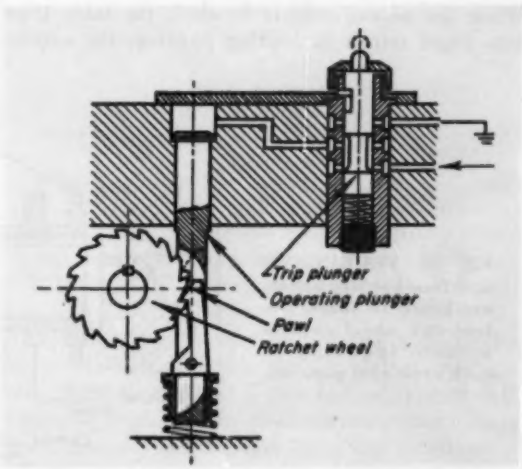


FIG. 2. THREE-WAY TRIP VALVE controls flow to operating plunger which actuates cycle cam.

vides either pressure or reservoir connection to both ends of the operating cylinder. Pressure on both ends may be used to furnish a neutral position to a sliding cluster gear. Reservoir connection on both ends—as shown here—may be used for de-energizing two reversing feed clutches to drive the shaft at a rapid traverse rate.

All the elements of the cam assembly are keyed to a shaft for proper timing. A longitudinal section of the assembly is shown in Figure 4. The various cams and spacers and the detent star wheel which fixes the indexing of the shaft are permanently locked against the shoulder. The assembly includes four cams for directional control of the table in feed and rapid traverse, for control of the vertical motion of the spindle carrier, and for starting and stopping the spindle. The shaft ends are formed into trunnions, and the cycle cam housing is provided with sleeves sliding axially to receive these trunnions.

One application of the cycle cam is on a rise-and-fall automatic milling machine without hydraulic tracer control for contour machining of shell anodes. With one touch of the starting lever, the table advances the work rapidly from the loading position to a position under the cutter and begins feed to the right. At the same time the spindle starts turning and the coolant begins flowing. The carrier moves downward, first rapidly, then at feed rate to contact a cam on the fixture. One side of the shell anode is contour milled in this manner. When this operation is completed, the table actuates a valve plunger and signals for rapid rising of the carrier. In the upper position, the carrier signals for the table to reverse at rapid rate to bring the center of the cross head under the cutter again. The table then begins left feed and the carrier moves down, fast at first, then at feed rate to contact the cam. When the second side is finished, the table trips into rapid return to loading position, the carrier returns to the top, the spindle stops, and the coolant flow stops.

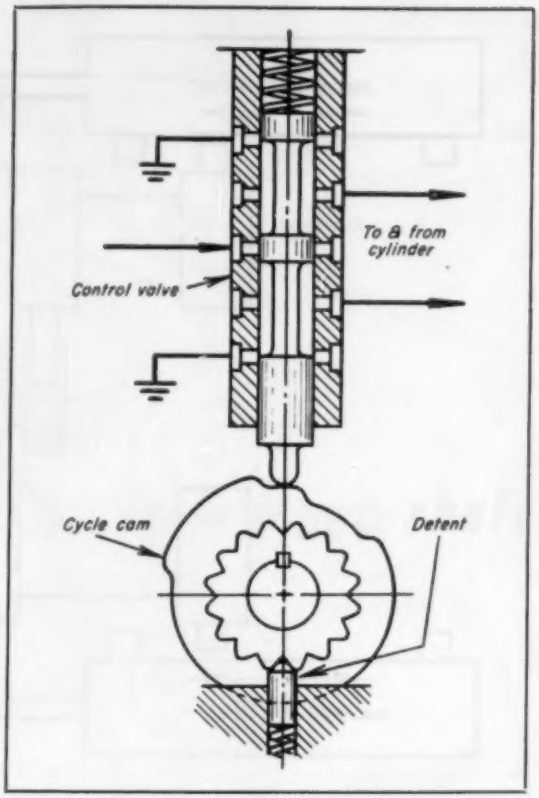


FIG. 3. CYCLE CAM POSITIONS spring-loaded, 3-position control valve to direct flow to cylinder or motor.

The cam shaft controlled hydraulic circuit uses oil pressure at 300 psi. Response to cam action is very fast. This excellent speed of response makes hydraulics a practical power source for production milling machines. ▼▼▼

This article is based on a paper delivered to the 1954 meeting of the National Conference on Industrial Hydraulics.

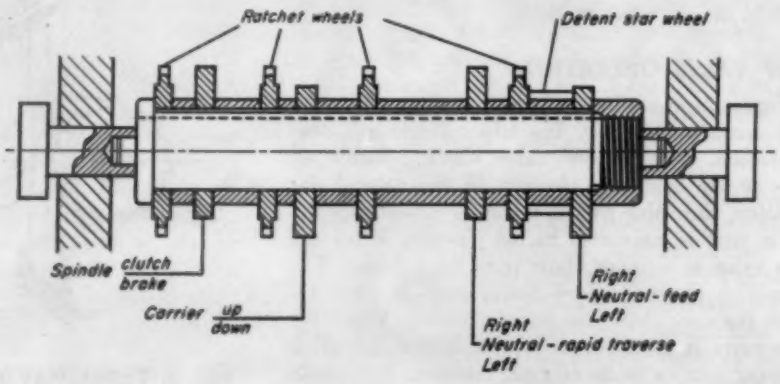
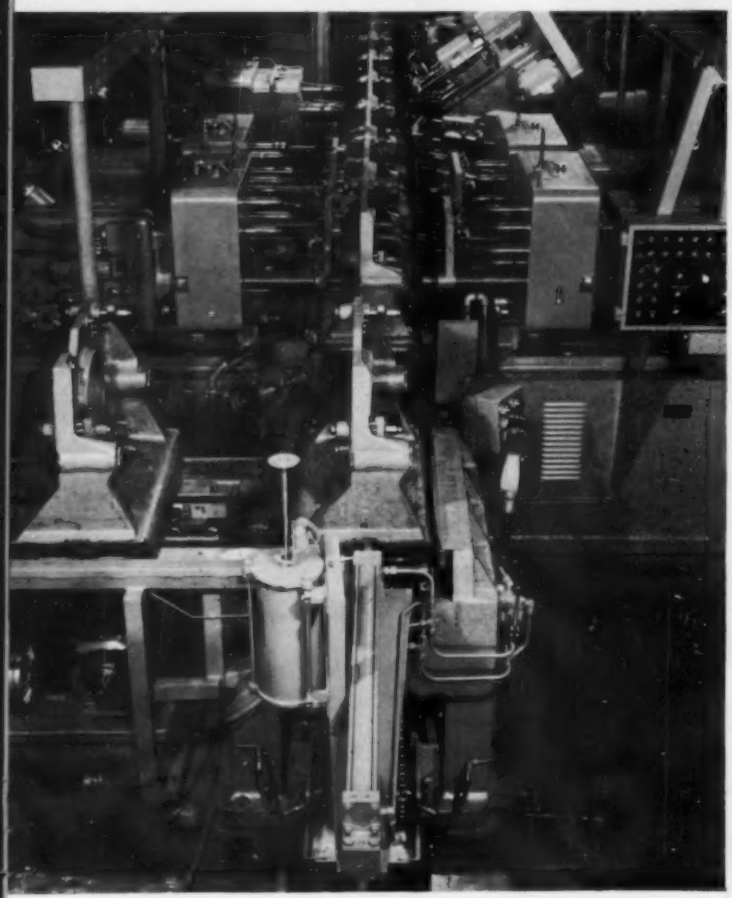


FIG. 4. FOUR CAMS and four ratchet wheels are keyed to shaft. Detent star wheel ensures accurate indexing in each cycle cam position.

Increasing demands for transfer machines mean that more and more fluid powered circuits will be used by the machine tool industry. Canadian machine builders who are active in developing high production machines are using • • • • •



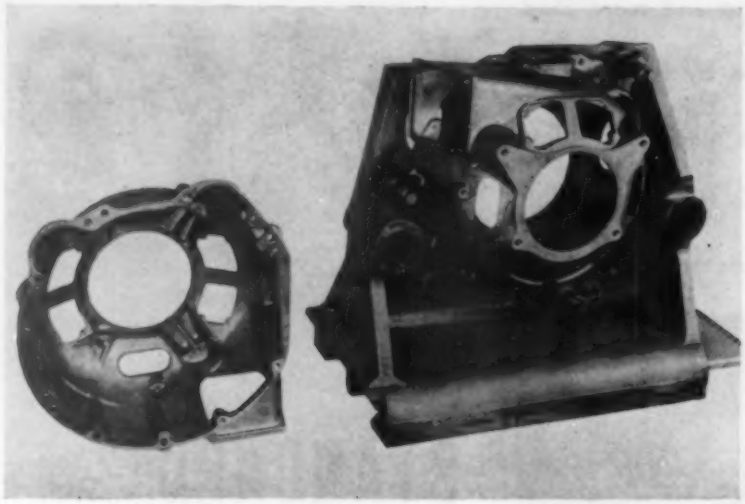
STANDARD COMPONENTS AND MACHINE TOOLS

HIGH production is the reason for building transfer machines. The large investment is not made because unusual and tricky designs are required. Investment in a transfer machine represents the purchase of many individual machine tools which have been tied together to operate as a unit. Automatic transfer devices shuttle the work through each station. Automatic handling results in the increased production.

Because reliability is of utmost importance, simplicity of design and the use of standard machines and components is the aim of the designer. This means that the designer who is familiar with hydraulics will use, wherever possible, circuits which have been successfully applied many times. Past experience with circuitry becomes very important.

Typical of the transfer units being installed by the automotive plants is the 12 station machine built by Modern Tool Works Ltd. of Toronto. It is capable of performing 5520 operations each hour in die cast aluminum torque converter housings.

Just how does a builder like Modern work out the design? It all starts with their sales representative who has the initial discussion with the customer



TORQUE converter housing is located in the pallet type fixture against a machined face. Pins in the fixture locate into two die cast holes. Once the part is loaded and clamped by the operator, the fixture "rides" through the 12 working stations on an automatically controlled cycle.

to learn what operations must be performed. In this case, the housing requires 34 drilled holes. Two holes require reaming; ten are to be tapped.

A process and planning department receives this information along with a drawing of the work piece. A process engineer, taking over the project, starts by determining the number of operations and working out a practical grouping of the operations in relation to multiple spindle heads. Once the operations have been grouped, horsepower and thrust requirements for each individual group are calculated. On this job, 12 work stations were set up. At each station, a standard self-contained hydraulically fed multi-spindle unit is used.

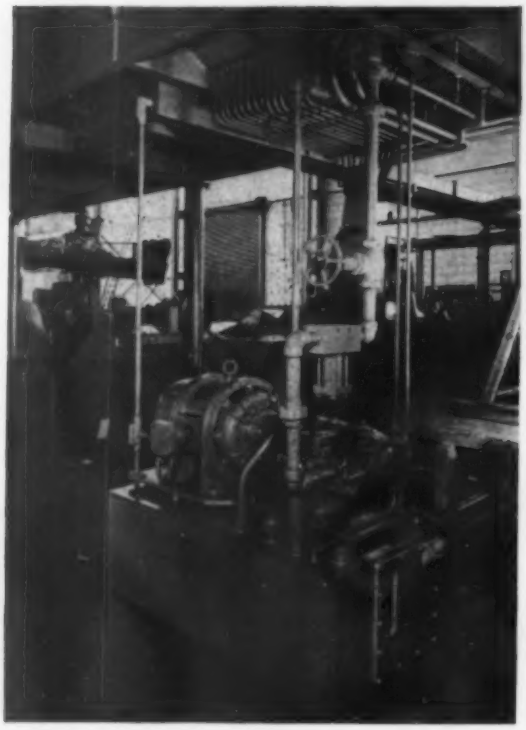
Grouping of operations is largely determined by the necessity of first tap drilling, then chamfering and finally tapping.

After selecting the individual machines and arranging them in the proper order, a proposal drawing is made to scale. Sequence of operation is listed along with an estimated production capacity and notes on the required work handling devices.

At this point the capacity of the hydraulic transfer system and cylinder sizes are determined based on the required transfer time.

An estimator now gets the job of breaking down the entire project to come up with a price. This along with a detailed description of the machine goes back to the customer.

Now there is a dwell to permit customer action.



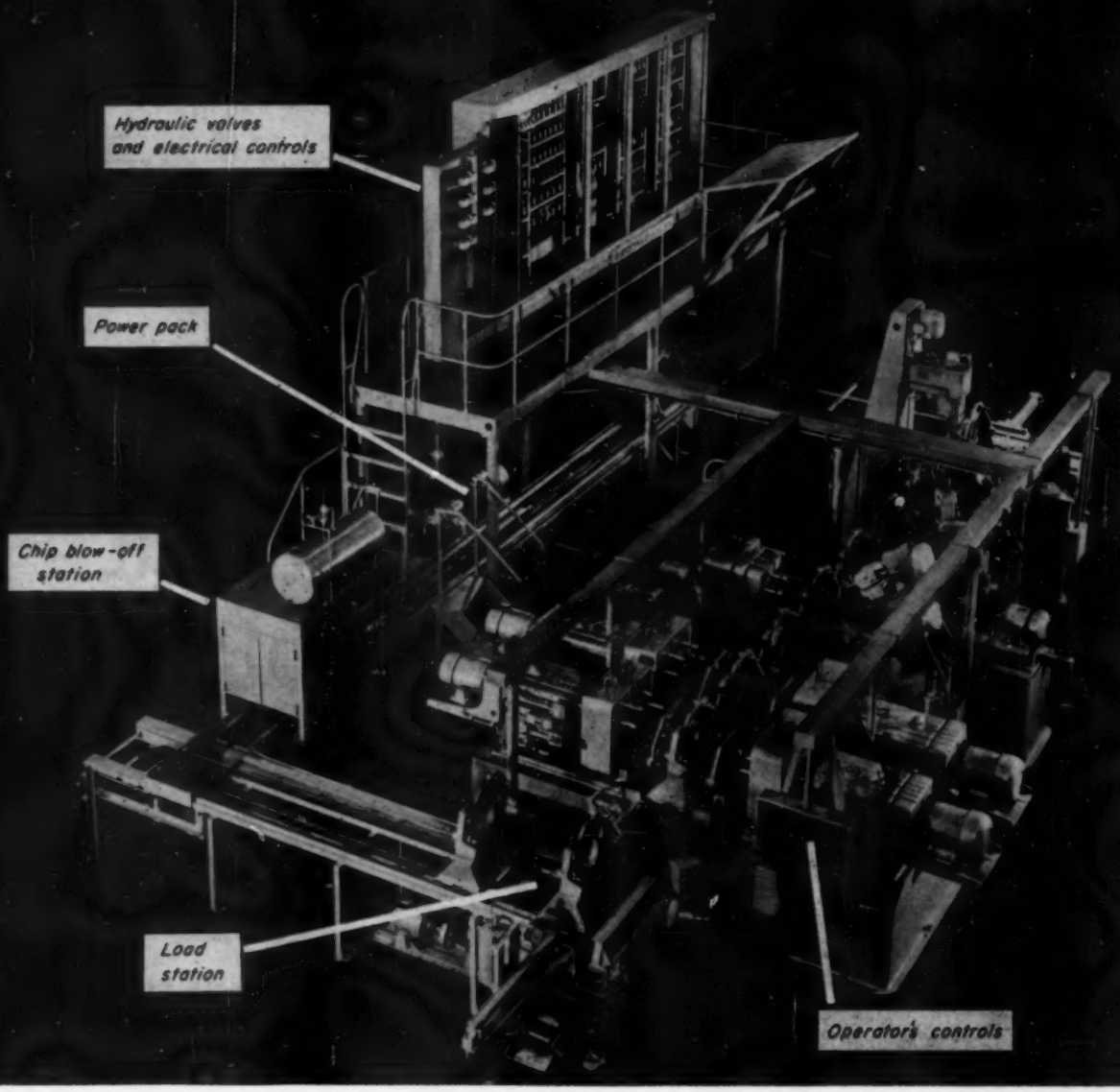
AND WITH THE ORDER IN . . .

With an order placed, the proposal drawing and quotation is given to a designer. He makes a rough layout to double check the proposal and from there the actual design begins.

As the design progresses, particular makes, models and sizes of hydraulic equipment are selected. To develop the circuit, the designer works with the chief draftsman, electric circuit designer and in some cases a representative of the company supplying the hydraulic components.

With the circuit completed and line sizes estab-

HYDRAULIC POWER for the transfer system is supplied by a two pressure hi-lo pump operating at a maximum of 500 psi. Pressure and drain headers go to the overhead valve panel.



TWELVE STATION machine can perform 92 operations a minute on die cast converter housing.

lished, physical location of the lines and valves is decided.

On the 12 station transfer machine, all valves are in a single cabinet beside the electrical control cabinet up on the mezzanine out of the way. This location saves floor space and puts the solenoids of the various valves as close as possible to their respective electrical control equipment for ease of service. Below the hydraulic panel is a tray with a drain pipe running straight down into the reservoir of the power package, so that any leakage that might occur on the panel will be carried away.

The power package is located on the floor because of its great weight and to be as accessible as possible for daily topping up of the reservoir. Hydraulic lines are suspended below the overhead electrical ducts out of the way, yet easily accessible for service. Overhead lines are also less liable to be damaged. Unions are provided at various points to permit ease of replacement and alteration. The entire system is built to J.I.C. standards.

The final design provides flexibility to accommodate future component changes, or retooling to suit a different work piece. Through the use of standardized elements, additional work stations may be easily added to further extend the useful life of the basic machine.

This step in standardization in automatic transfer machines makes use of existing elements of proven design to further insure better performance and higher production, and provides a basis whereby improvement can be made to standardized assemblies. This approach will reduce the special content of such machines to a point where the tooling will be the only special portion, resulting in better, more useful machines at a lower price. ▼▼▼

VALVE BLOCK on six speed chucking machine contains dual pressure relief valve.

DUAL PRESSURE RELIEF VALVE

...improves chucking machine circuit

• By Robert C. Ebersold

FIVE clutches in the transmission of a six speed single spindle chucking machine are operated hydraulically. When the spindle is being driven, the clutches, which are designed to carry maximum motor torque, require 125 psi oil pressure. However, during braking, two of the clutches, C4 and C5, are used and must be operated at a reduced pressure of 60 psi. Use of the reduced pressure produces a soft, cushioned fast brake action which does not impose excessive shock loads on the machine components.

On the first pilot model of the new transmission, two separate relief valves were used, Figure 3, to give the 125 psi clutch operating pressure, and the 60 psi brake pressure. With this circuit, a check with pressure gauges when the transmission was in brake position showed that the pressure on clutch C4 was considerably greater than the pressure on C5. This pressure differential which amounted to about 40 psi was considered undesirable because excess slipping and premature failure of C5 was possible.

Examination of the circuit showed that this pressure drop was largely due to the location of the low pressure relief valve. It became apparent that if the 60 psi relief valve was located at the same place in the circuit as the 125 psi relief, much of the pressure drop between clutches could be eliminated. If a method could be devised to make the two pressures available at the same valve, it would give the required performance.

COMBINING THE TWO VALVES

Upon observation of the two valves and the realization that the two required pressures were being obtained by two valves which were identical in construction except for springs, it was reasoned that one spring when combined with two different piston areas would also result in two system pressures. This is the valve shown in Figure 1. The normal 125 psi pressure is obtained when oil is directed to the center port, 2, where it acts on the ½ inch diameter piston "C". The oil is discharged through the 9/16 inch diameter hole which is drilled beyond the piston bore, giving the same hydraulic balance effect as an annular groove. When reduced pressure is required, the oil is also directed to the end hole, 1, where it acts on piston "A", which is ⅝ inch diameter. Piston "A" provides the additional area

Continued on page 112

ROBERT C. EBERSOLD, *Development Engineer, The Warner & Swasey Co., Cleveland, Ohio.*

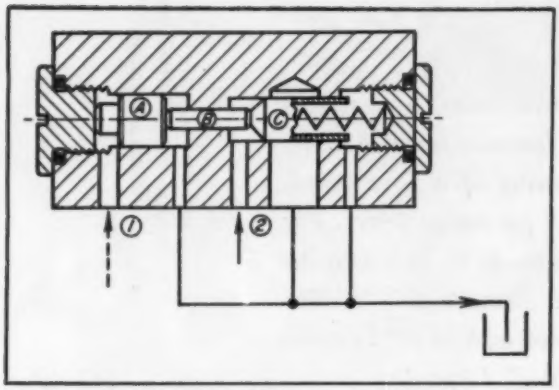


FIG. 1. TWO PRESSURES at ports 1 and 2 can be limited by this special relief valve.

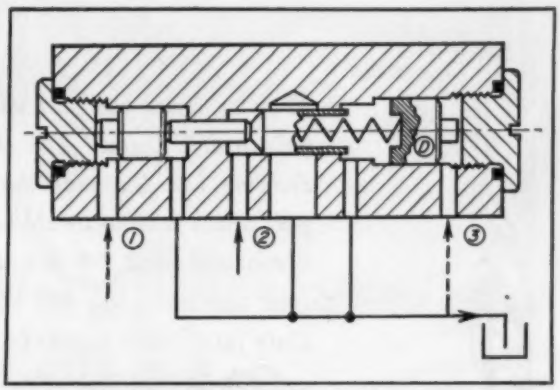


FIG. 2. FOUR PRESSURES could be available with this valve in the circuit.

FIG. 3. ORIGINAL CIRCUIT for the chucking machine used two separate relief valves to limit pressure for both clutch and brake action. While theoretically this circuit should give the required pressure control, in practice, it did not. Because of the location of the low pressure relief, there was a pressure drop in the line which resulted in a higher pressure on clutch 4 than on clutch 5 during braking.

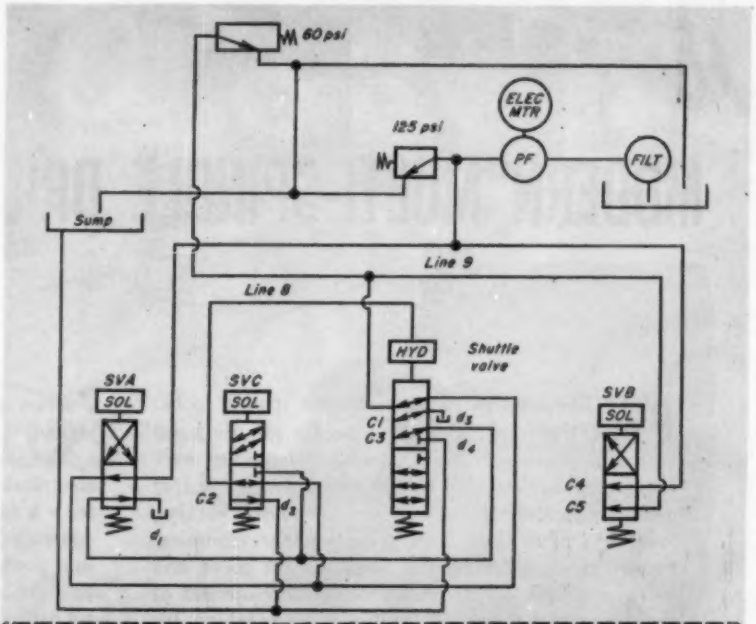
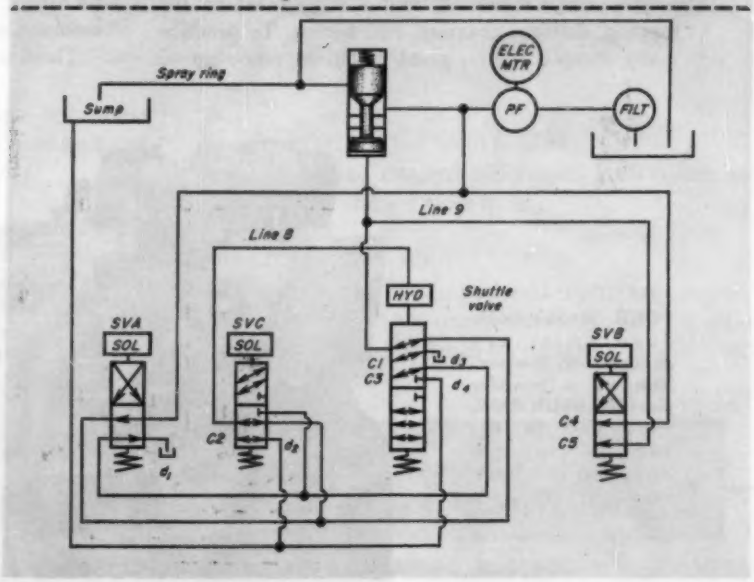


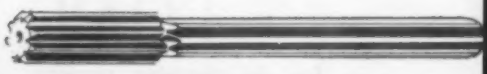
FIG. 4. EQUAL PRESSURES on clutches 4 and 5 result when the dual pressure relief valve is used. Combining both relief valves permitted reduction of the flow path in the circuit so that there is a very nominal pressure drop between the two clutches during braking. Equal pressure on the clutches is desired to minimize clutch wear.



"You designed the part with those holes. Now tell us how to drill them!" The shop foreman stood over my drawing board waving the drawing of a very simple part which was no trouble at all for me to design. The drawing showed a 3 inch diameter 3/16 inch stainless steel disc which had 492 1/8 inch diameter drilled holes. Only 56 of them had to be tapped with an 8-32 thread.

"What seems to be the trouble?" I asked.

Shop Folklore

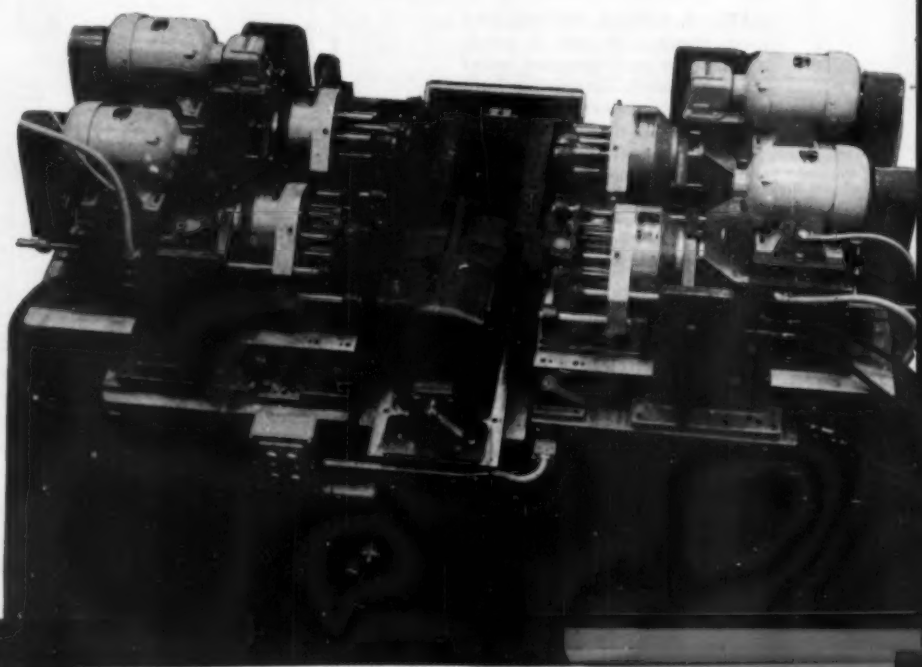


MODERN MULTI-SPINDLE DRILLING AND TAPPING

PUTTING holes in metal isn't what it used to be. Sure, there will always be single spindle hand fed drill presses in every machine shop. But ever since someone decided to put two holes instead of one in a part, machine designers have been working out ways of drilling both holes together. Complexity of product design and demands for more and more parts per hour has led to the development of fluid powered feeds on multi-spindle machine for tapping, drilling, reaming, and boring. To produce many complex parts, giant machines made up of a series of multi-spindle feed units have been designed.

The feed unit made by Zagar Tool, Inc. uses an electrically controlled hydraulic system to give the tools a fast approach to working position, a closely controlled feeding speed, and a rapid return to original position. Multiple hole patterns of several hundred holes—such as found on gas burners—may be drilled with this unit when suitable fixtures are mounted on it.

These units have been used many times on mul-



FOUR multi-spindle feed units are grouped on this section of a transfer machine which drills, taps, and reams holes in a complicated die cast housing.

NEW PERFORMANCE
continuous duty constant delivery operation—volumetric efficiency over 90%—7 sizes—single pump discharge 12 to 40 gpm*—single motor output 12 to 38 hp*
*(1200 rpm @ 2000 psi)

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extra large gear bearings maintain shaft alignment—special tapered roller outboard bearings absorb all drive shaft and shock loadings—new leakproof oil seals prevent leakage

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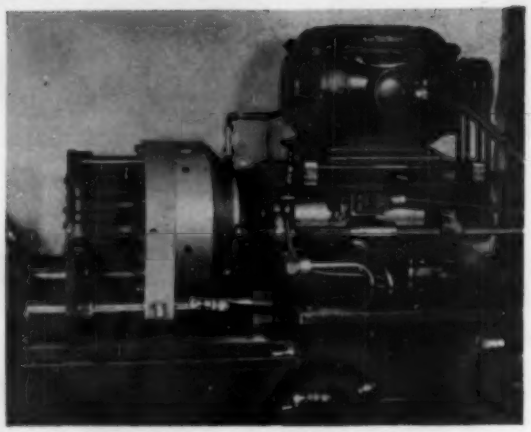
tiple operation jobs where several work stations are required to machine a part. They can be mounted onto a main tank or base in clusters like spokes around the hub of a wheel, or four units opposed to each other, or in a straight line transfer machine. They may be mounted vertically, horizontally or any desired angle. Whether working in synchronization or in any variation of sequence, these units may be electrically controlled to split-second cycling.

1000 PSI HYDRAULIC CIRCUIT

Each unit has its own hydraulic system composed of a 1000 psi vane type pump powered by a 1 hp motor. The pump is protected by a relief valve which may be adjusted to the requirements of the job.

Directional control of pressure oil to each side of a double acting cylinder is accomplished by the use of two single solenoid spring return 4-way valves, one of which has one plugged port. The speed of the work stroke is controlled by a "meter-out" flow control valve. This valve also supplies adequate back pressure in the line to prevent a lunging surge when drills break through the work.

When both solenoids are deenergized, pressure oil from the pump has free flow back to tank at no pressure. This conserves horsepower during idle time. When rapid approach to working position is desired, both solenoids are energized. This directs full volume of oil to the head end of the cylinder and allows free flow of oil from the rod end to tank.

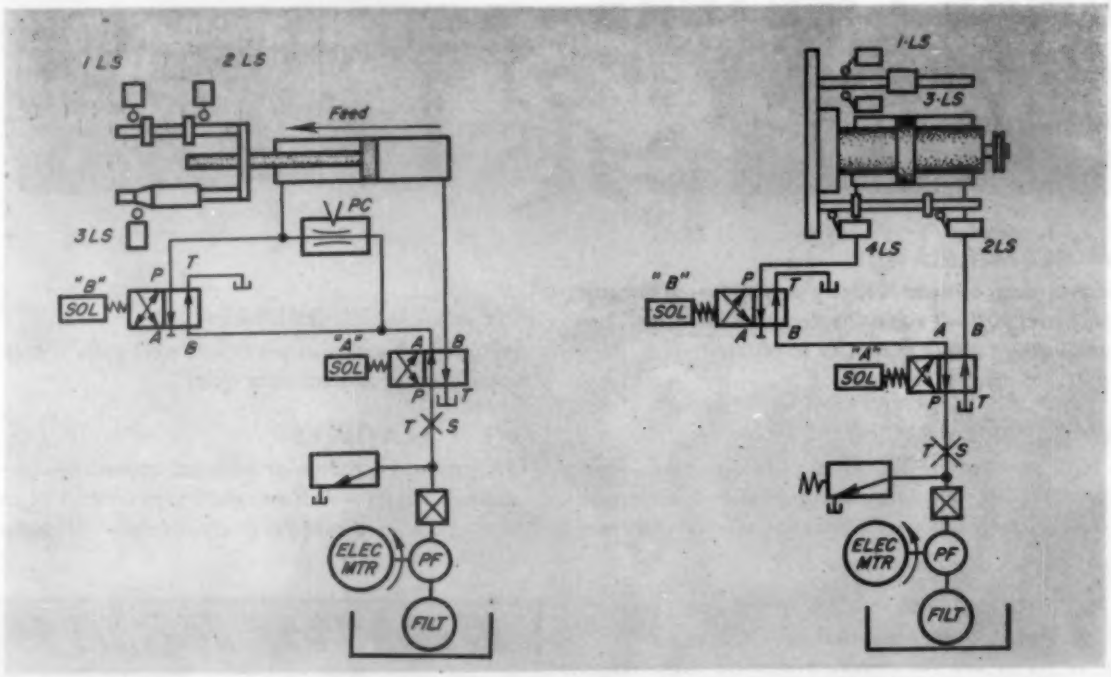


CAM operated limit switch initiates drill feed after a rapid approach stroke to the work.

When slower work speed is required, solenoid "B" is deenergized. Return oil from rod end is now blocked by the blocked port and is forced to return to tank through the flow control valve. When solenoid "B" is energized and solenoid "A" is deenergized, full volume of oil is fed to the rod end of the cylinder causing the rapid return stroke to the starting position.

The valves are all sub-plate mounted on a steel insert which also contains the oil tank, motor, and pump. The two pressure lines to the cylinder are

Continued on page 113



DRILL CIRCUIT is designed to give a fast approach of 43 ipm. Feed is controlled from ¾ to 20 ipm. The head returns at a speed of 80 ipm.

TAPPING CIRCUIT uses hydraulics to rapidly move the taps to the work. Taps are fed into the work by a lead screw.

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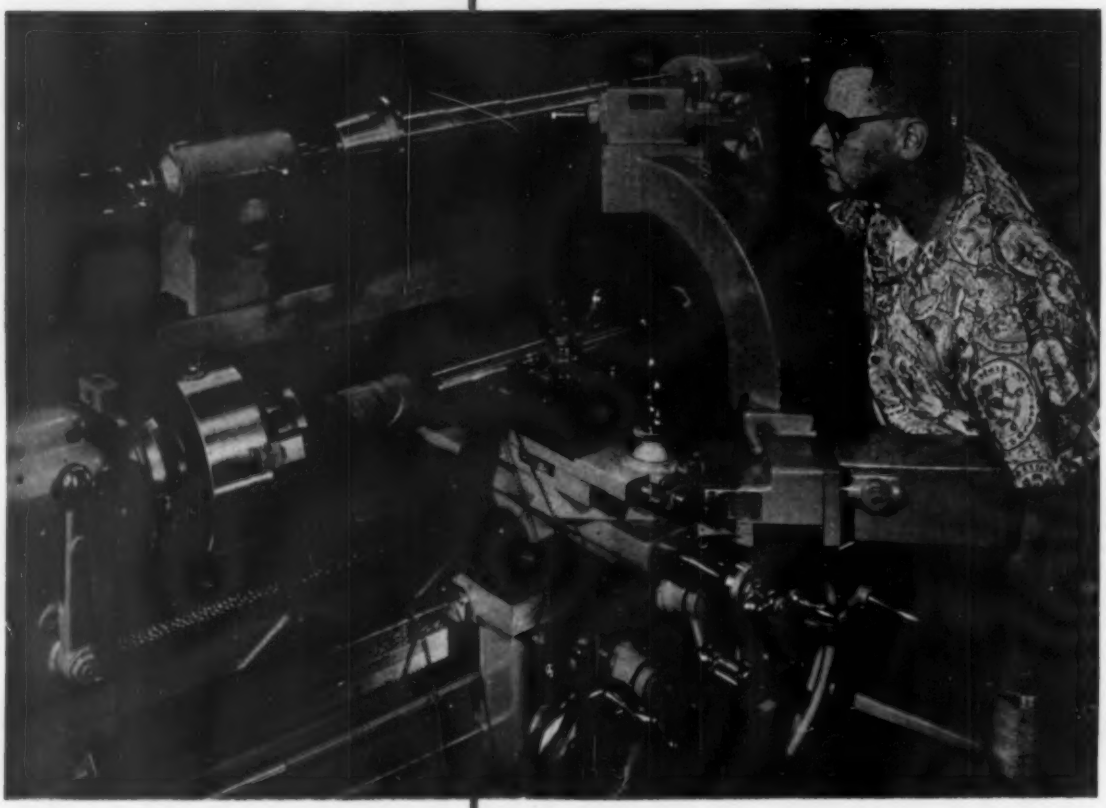
MACHINE TOOL TRACER CONTROL



Courtesy Rockford Machine Tool Co.

● By Allan E. Morris
Associate Editor

Servo control systems for machine tools may be electric, electronic, electro-hydraulic, or various combinations of these. A study of all factors involved indicates that hydraulic systems are the best choice for most machine tool applications because of their comparative simplicity, and flexibility of control.

DEVELOPMENT and perfection of automatic machines can sometimes be a dangerous affair. A special-purpose machine may perform an amazingly intricate operation with a minimum amount of supervision, but it may also lack the versatility to permit its adaptation to new jobs as designs are changed. An alternative to the special-purpose machine is a standard machine which can be modified for automatic operation on a variety of jobs. This modification can be easily accomplished with a hydraulic tracer.

Hydraulic tracers can be applied to practically all machine tools to control movement in one, two, or three directions. On a lathe, for example, the control system must move the cutting tool in and out—one dimension—while on a large boring mill it may perform three func-

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RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

tions, controlling the spindle, vertical head, and horizontal table. All types of work with uninterrupted cuts including square or tapered shoulders, flanges, radii, tapers, grinding necks, form-turning step shafts, and contour facing can be performed with the use of hydraulic tracers. Because the smooth operation of the hydraulic components results in smoother finishes on the work, subsequent operations can frequently be eliminated. In contrast to other types of control systems which may produce a step finish on taper and contour work, hydraulic feeds are inherently smooth and often produce finer finishes than mechanical feeds.

TRACER CONTROL SYSTEMS

Tracer control systems consist essentially of three elements: the tracing head, machine operating cylinder or fluid motor, and power unit. Blueprint dimensions of the part to be machined are transferred to a template. This template is traced by a finger of the tracing head or sensing element which is a sensitive hydraulic valve actuated by the movement of the finger. The valve meters oil flow to the operating cylinder or fluid motor which replaces the conventional screw or rack and pinion feed. The power unit consists of the conventional motor, pump, and necessary relief valves to supply flow for the system.

TRACER UNITS

The two-way tracer valve shown in Figure 1 includes a valve consisting of a piston and sleeve with hydraulic ports machined into these parts. A deflection of the tracer tip from any point 360 degrees around the circumference acts through the "V" ball bearing and results in corresponding movement of the tracer piston.

Another design of tracer unit is shown in Figure 2. This unit controls three sliding machine elements at 90 degrees to each other. The unit consists essentially of three valves which are actuated by a spindle pivoting in a ball joint and also moving up and down. A tracing finger is attached to the end of the spindle to contact the template. The spindle top bearing is held in a slide and the middle bearing moves the two horizontal valves. The vertical valve is moved by up and down movement of the spindle. A rate adjustment screw adjusts the amount of slide of the upper spindle bearing. This controls the amount of movement of the two horizontal valves and consequently limits the amount of oil flow to

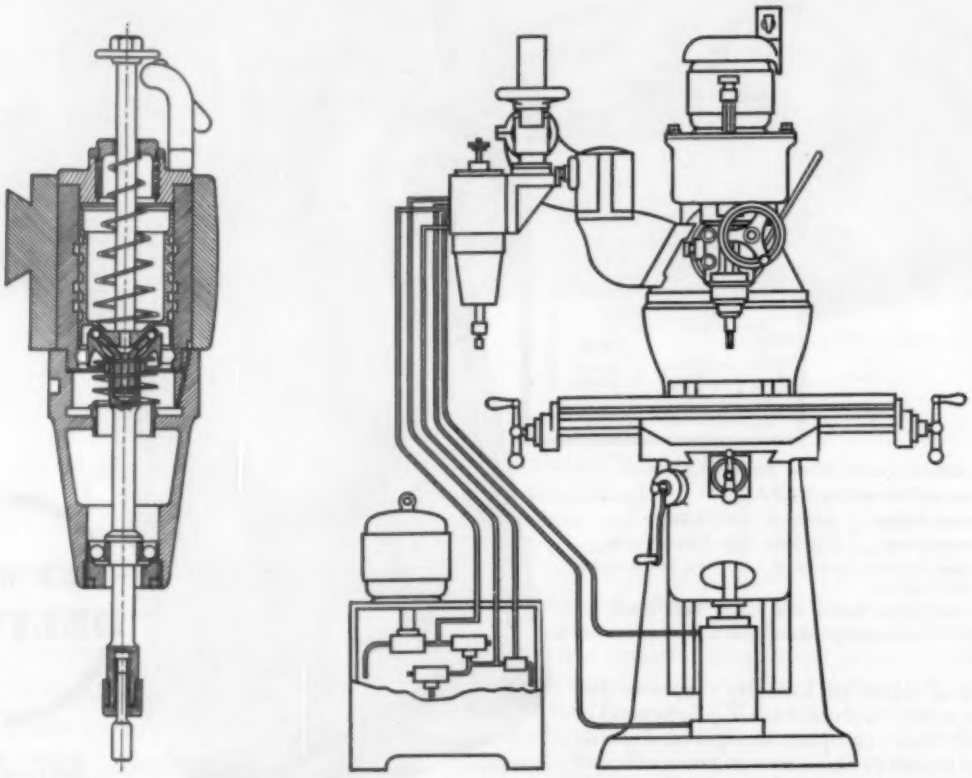

FIG. 1. APPLICATION OF TRACER CIRCUIT to a vertical milling machine. Tracer unit has a "V" shape ball bearing to translate circumferential forces on the finger into movements of the valve piston.
Courtesy Turchan Follower Machine Co.

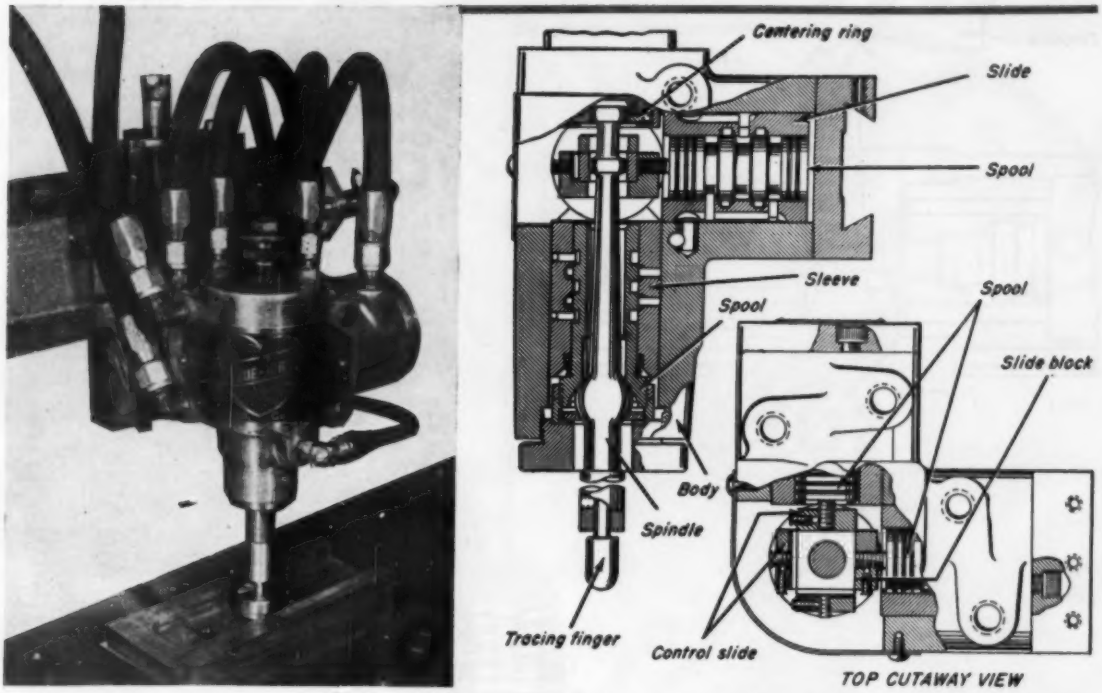

FIG. 2. TRACER UNIT for control of machine motions in three directions. Tracer spindle pivots on ball bearing to actuate two valves. Up and down movement of spindle moves third valve. *Courtesy True-Trace Corp.*

the operating cylinders regulating the speed of operation of the cylinders.

The valve spools have lands which match grooves in the valve sleeves. A screw adjustment permits accurate alignment of the lands and grooves. This type of annular valve assembly is very sensitive to linear movements. A port opening of only .001 inch permits a volume of oil to flow through the ports equal to an orifice approximately 1/16 inch in diameter. In order to compensate for different areas on the head end and the rod end of the operating cylinders so that the operating cylinders have the same speed in each direction, the spools are adjusted so that the ports leading to the head end of the cylinder open farther than the ports leading to the rod end.

TRACER CONTROL CIRCUITS

In the tracer circuit diagrammed in Figure 3 the problem of differential areas of the operating cylinder has been solved in another way. Here again a pivoted arm actuates a valve which controls flow to the operating cylinder. However the valve regulates the pressure on only one side of the cylinder. System pressure is always acting against the rod end; reduced pressure acts against the head end. Since the rod end is one-half the area of the head end, the rod end pressure must be twice the head end pressure for the piston to be balanced. The middle land of the valve is slightly narrower than the corresponding groove in the valve body. Thus when the valve is centered, oil leaks from the pressure side to the exhaust side. When the valve is centered, the pressure on the head end is exactly half that on the rod end and the piston is centered. Movement of the valve to the right increases the

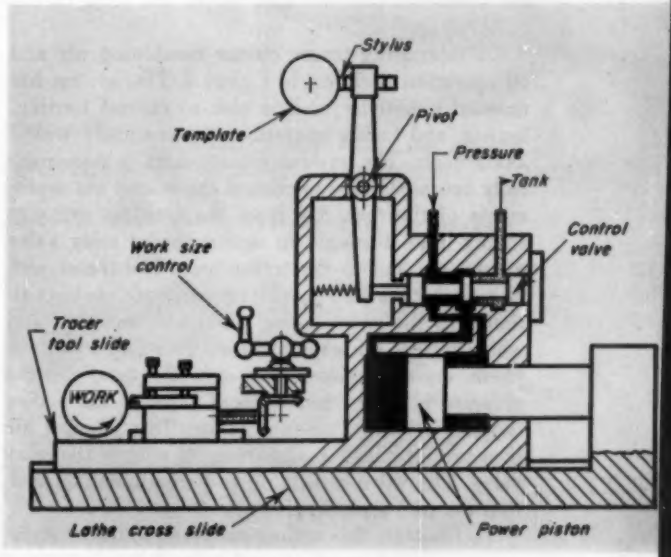

FIG. 3. DIFFERENTIAL FORCE acting on piston moves machine slide in this tracer circuit. Reduced pressure acting on piston head end opposes full pressure acting on rod end.

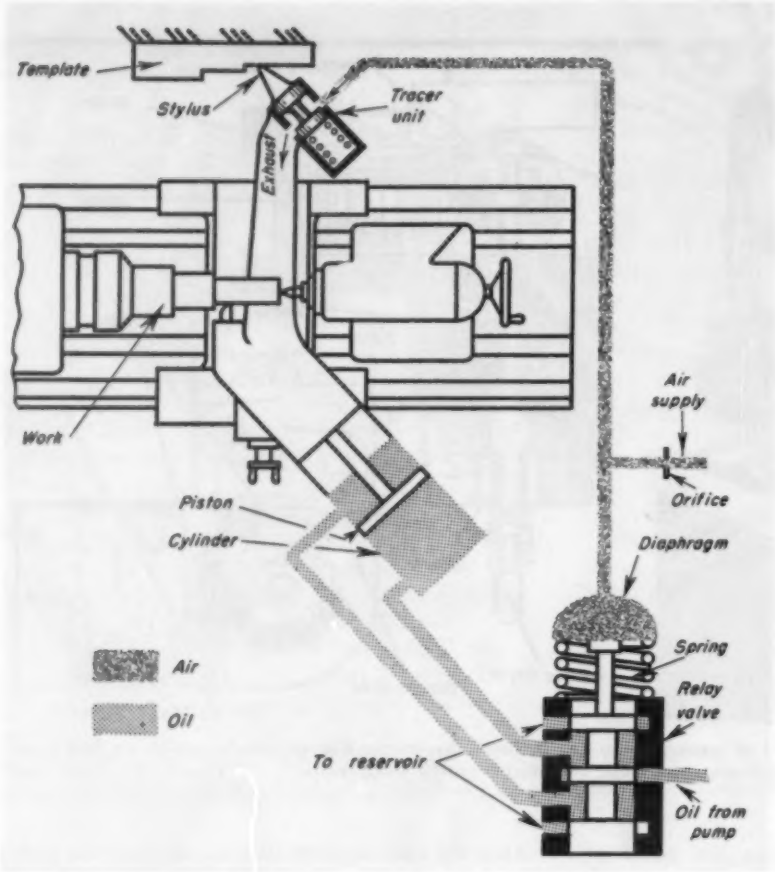

FIG. 4. AIR AND OIL are combined in this sensitive control circuit. Contour pilot valve controls cross feed of tool. Feed pilot valve controls longitudinal speed of tool.

Courtesy Monarch Machine Tool Co.

head end pressure and moves the tool slide to the left. Movement of the valve to the left decreases the head end pressure and moves the slide to the right.

An interesting tracer circuit combining air and oil operation is shown in Figure 4. This system has unusual sensitivity, and is able to control turning, boring, and facing operations automatically within .0001 inch. The system incorporates a pneumatically operated valve to control the in and out movements of the tool. Air from the constant pressure supply flows through an orifice to the relay valve diaphragm and to the tracer unit. The tracer unit is a spring-loaded, spool-type valve which is positioned by the stylus riding against the template and which meters the amount of air escaping to atmosphere. As the stylus moves over the template, the pressure is raised and lowered because the orifice supplies a limited amount of air. This varying air pressure actuates the diaphragm to control the relay valve. The valve directs oil to the cylinder to position the tool accordingly.

To illustrate this action, suppose the tracer stylus moves away from the template to follow a convex shape. The amount of air escaping increases, decreasing the remaining air pressure and allowing the relay valve to move up. This opens the head end of the cylinder to drain and the rod end to pressure. The piston retracts moving the tool away from the work to form the same shape as on the template. Since the tracer unit is connected to the piston, as the piston moves out, the tracer stylus extends to raise the air pressure. The cylinder will be balanced when the tool bears the same relation to the work as the tracer stylus to the template. Because an unbalance causes almost instantaneous movement of the tool, the system does not vary much from balance.

The tool is mounted at a 45-degree angle with the work permitting the machining of square shoulders. The deflection of the tracer stylus determines the movement of the relay valve and consequently the speed of the tool moving in or out. The relationship of the tool speed to the longitudinal feed of the cross slide determines whether the contour will be a bevel, chamfer, taper, square shoulder, or other shape. Because there is no dead center in either the air or oil valve action, there is a flow even when the system is balanced. This results in a vary fast and accurate response.

CHARACTERISTICS OF TRACER SYSTEMS

Tracer systems, like other servomechanisms, have

Continued on page 112

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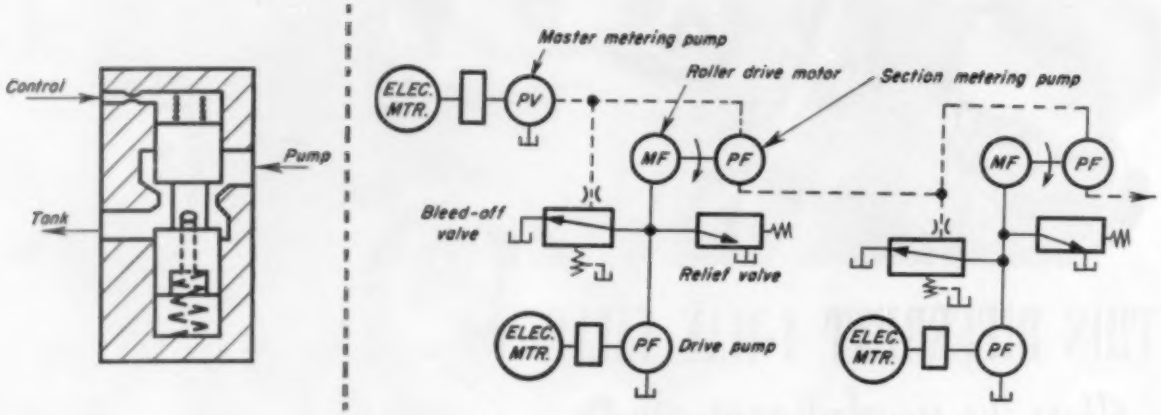


FIG. 1. IT IS IMPOSSIBLE to detect inaccuracies in speed control by ordinary measuring methods, when this circuit is used over a speed range of 15 to 1. Detail of bleed off valve is at the left.

● By J. R. Fawcett

FLUID motor drives for rolls on processing machines offer the advantages of lower cost and greater flexibility of control when compared to many mechanical and full electrical systems. A major problem confronting the designer of a multi-roll drive is the control of relative speeds between rolls.

A solution to this problem requires a circuit which will not be affected by pump slip, oil compression, changes in load and variations in oil viscosity. Several successful circuits have been developed. The circuit shown in Figure 1 has the advantage of using fixed capacity main drive pumps and motors. This circuit gives a high degree of accuracy over wide speed ranges and variations of load. The inaccuracy has been found to be so little that it is incapable of detection by ordinary speed measuring methods over a speed range of 15 to 1.

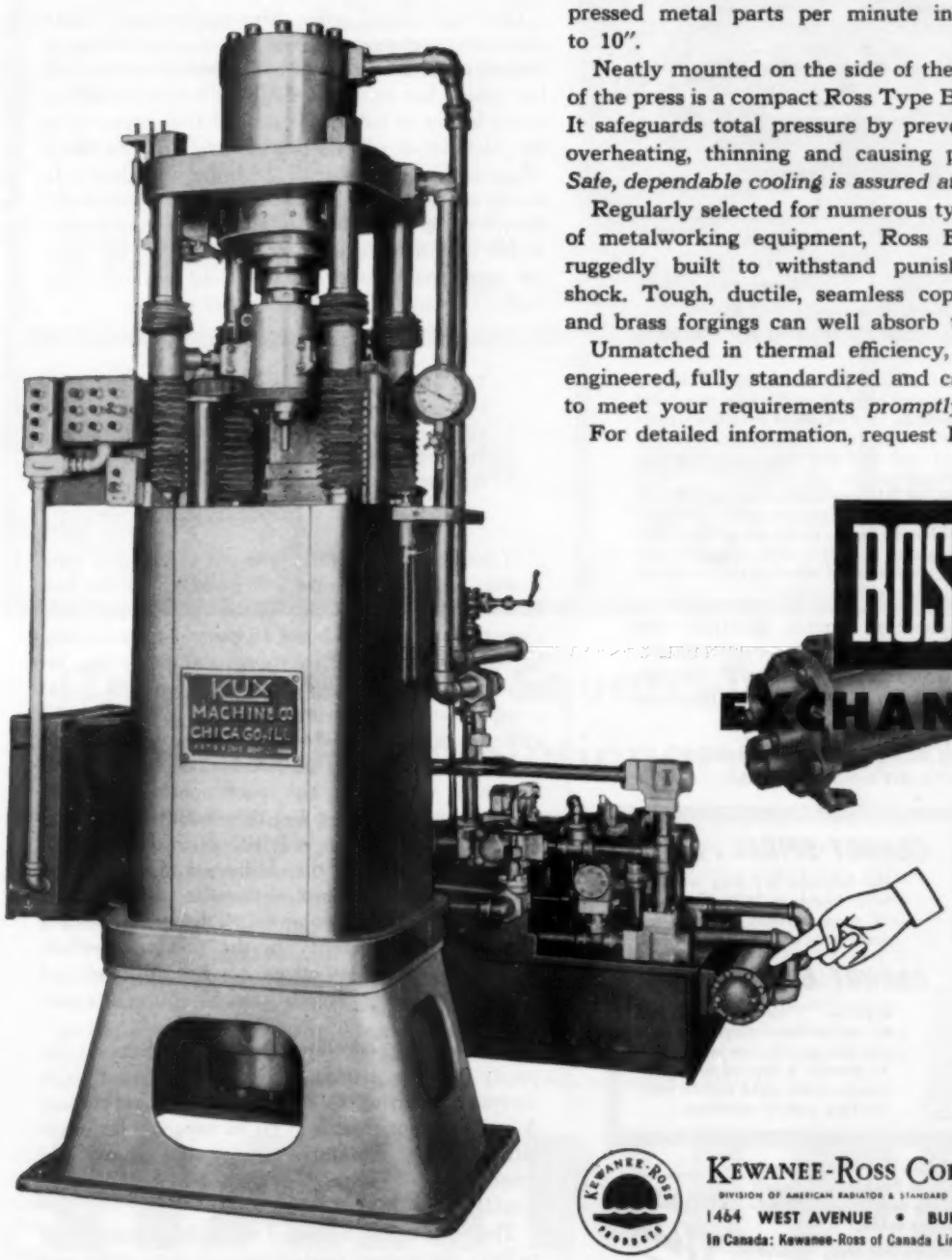
Each main drive pump is driven separately and connected directly to its hydraulic motor. The pump capacity must be in excess of the maximum motor demand as the speed is controlled by discharging oil to tank through the bleed off valve.

The bleed off valves are actuated by a separate control circuit consisting of a master metering pump and a number of section metering pumps driven by the roller drive motors which are being controlled. The metering pumps are high efficiency gear type units working at only 30 psi. The oil in the control circuit passes through all pumps in series and is then discharged to the tank. Because of the low pressure and absence of load on the control pumps, no inaccuracies from slip or oil compression are introduced as is the case when speed control is attempted by using restriction type valves or variable delivery pumps for the main drive.

MASTER PUMP CONTROLS SPEED

Each section of the control circuit has its own metering pump and bleed off valve. The section metering pumps are shown as fixed capacity units. Variable capacity pumps are used when independent adjustment is required for each section. Once the relative speeds of the sections have been settled, the speed of the whole machine is controlled by the

Ross Exchanger safeguards total pressure of this new 100-ton Kux Powder Metal Press



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Neatly mounted on the side of the hydraulic unit of the press is a compact Ross Type BCF Exchanger. It safeguards total pressure by preventing oil from overheating, thinning and causing pump slippage. *Safe, dependable cooling is assured at all times!*

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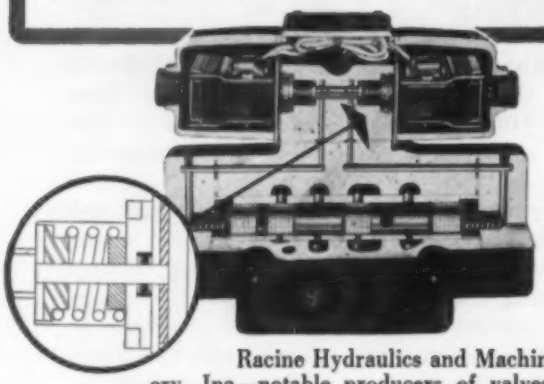
PALMETTO G-T RING®



Racine Hydraulics and Machinery, Inc.—notable producers of valves, boosters, pumps and pumping units—recently introduced their Twin Solenoid Pilot Operated 4-Way Valve. For the dynamic seal operating at working pressures to 2,000 psi Racine selected the Palmetto G-T Ring. Read why:

"We have solved our sealing problems since Palmetto G-T Ring was first designed into our valve line two years ago. This was a very definite improvement over the former seals which had given various forms of trouble. The G-T Ring provided a good seal that did not roll, twist nor extrude into the clearance spaces.

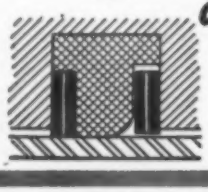
There is a minimum of friction in the Racine "Twin" Solenoid Valve. The G-T 3/16" diameter seal allows dependable delivery of solenoid power to the pilot spool each time a solenoid is energized. No noticeable change of seal friction is experienced, regardless of whether the solenoids are on occasional or high cycling circuits."

This successful application further illustrates the versatility of the G-T Ring. For your applications—static or dynamic—involving pressures to 20,000 psi, try the G-T Ring. It will give *you* definite improvement, too!

INVESTIGATE THE MANY DESIGN ADVANTAGES OF PALMETTO G-T RING PACKINGS.

CANNOT SPIRAL . . .

The Palmetto G-T Ring will not twist and turn in the groove. "T"-form prevents leakage—reduces static and dynamic friction.



CANNOT EXTRUDE . . .

Resilient "T"-section supported by non-extrusion rings on either side *makes extrusion impossible.* As pressure is applied non-extrusion rings are urged against wall, blocking path of extrusion.

Write for our Manual MP-200, Engineering Standards for Palmetto Molded Packings. Consult Green, Tweed's engineering department... Qualified assistance yours for the asking!

PALMETTO Packings

packing more performance into every application

GREENE, TWEED & CO. North Wales, Pa.

SYNCHRONIZING MOTOR SPEEDS

variable capacity master metering pump output.

One end of the piston in the bleed off valve is acted on by the control pressure, the other end is at zero pressure. The control spring holds the valve open and allows the main drive pump delivery to pass to drain until the control pressure builds up sufficiently to overcome the spring. The weak upper spring is only intended to stop piston bounce. There is a restriction in the control line passage to stop hunting.

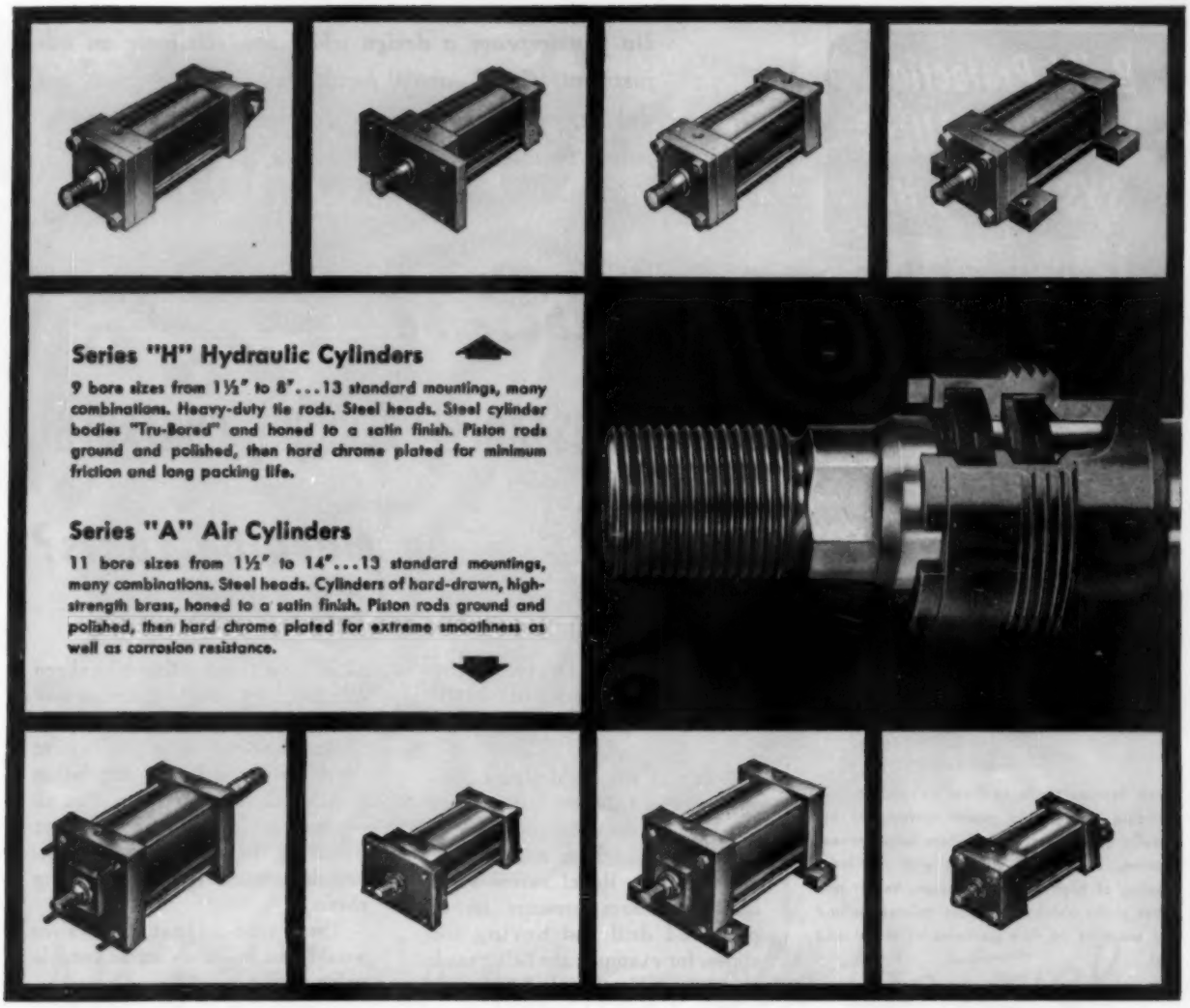
Operation of the roller drive motors starts when the master metering pump is started. Pressure from the master metering pump is delivered into a closed line which has no outlet until the section metering pump begins to rotate. Because of this, pressure in the pilot circuit will rise rapidly and keep the bleed off control valve shut until the roller drive motor is nearly up to speed. If the master pump is set to deliver 1 cu in a minute, then all the metering pumps which now operate as motors driven by oil from the master pump must run at a speed corresponding with a capacity of 1 cu in a minute also.

This article is one of a series about control problems. Other pressure and speed control circuits were detailed by Mr. Fawcett in the April, June, July and August issues.

If the first section pump gets out of step and runs slower, then the pressure will build up in the line between the master and section pumps and will close the piston in the bleed off control valve slightly to reduce the leak-off rate until the motor has regained the standard speed again. If the sectional pump becomes 1/10 revolution out of step, 1/10 cu in excess oil will be trapped in the line between the pumps. Since this oil would have no place to escape, it will act on the speed control valve. As this valve needs only a few thousandths of an inch for complete actuation, a 1/100 cu in difference in displacement is more than sufficient to operate the control. In the next section there is still a flow of 1 cu in per revolution even if there has been a slight speed irregularity in the previous section, because, since excess oil cannot be absorbed and there is no leakage, it must pass along the line continuously.

If a section metering pump has a different capacity than the master pump, its speed must be in inverse proportion to the capacity per revolution. A sectional pump with .5 cu in capacity per revolution should, therefore, run at double standard speed and will cause the main motor to run at double speed also.

The main drive pump and roller drive motor need to have the correct relative capacities to make sure that the motor has plenty of oil for the fast speed. ▼▼▼



Series "H" Hydraulic Cylinders

9 bore sizes from 1½" to 8"...13 standard mountings, many combinations. Heavy-duty tie rods. Steel heads. Steel cylinder bodies "Tru-Bored" and honed to a satin finish. Piston rods ground and polished, then hard chrome plated for minimum friction and long packing life.

Series "A" Air Cylinders

11 bore sizes from 1½" to 14"...13 standard mountings, many combinations. Steel heads. Cylinders of hard-drawn, high-strength brass, honed to a satin finish. Piston rods ground and polished, then hard chrome plated for extreme smoothness as well as corrosion resistance.

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The gland you see here represents the biggest improvement in cylinder design in the last 50 years. And, you'll find this gland only in Hannifin Square-Type Air and Hydraulic Cylinders.

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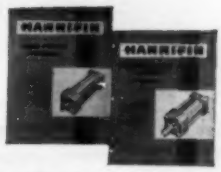
Find out how easily you can apply Hannifin Cylinders to your requirements. They're available for prompt delivery—in all sizes and all standard mounting styles—and at competitive prices despite all their exclusive features.



WRITE FOR BULLETINS

Bulletin 113. Series "H" Hydraulic Cylinders

Bulletin 213. Series "A" Air Cylinders

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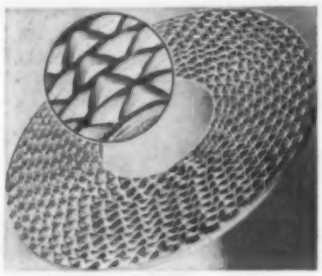

GRIDS GRIP GRIT

Liquid flows at low velocity through a stack of steel grids strongly magnetized by Alnico permanent magnets. The "honeycomb" design splits the stream and even the smallest ferrous particles pass close to and are caught on the magnetized grid edges (see inset above). All parts easily cleaned. FerroFilters have no moving parts; no replacement parts to buy; are quickly installed.

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Do you improve a design when you eliminate an adjustment? Could control handles on relief, pressure reducing, counterbalancing, sequence and unloading valves be eliminated?

Should there be

NON-ADJUSTABLE PRESSURE CONTROLS

on machine tools?

"Yes, let's eliminate adjustment screws. They only invite tampering."

It is very easy to design a pressure control valve so that it is impossible to adjust the pressure setting. Some machine tool builders are doing so. Relief valves which limit maximum pressure on oil powered drill and boring tool slides, for example, are being made non-adjustable. The drill or boring slide is designed for a given number of pounds thrust. If maximum pressure to develop that thrust is 800 psi, a spring which will give this pressure is put in the relief valve. No further means of pressure adjustment is provided. After-all, if the maximum thrust has been selected, why should there be any need to change the relief valve?

This non-adjustable feature doesn't mean a locked regulating handle—it means no handle at all—no means of adjustment except by taking the valve apart and putting in another spring or adding shims.

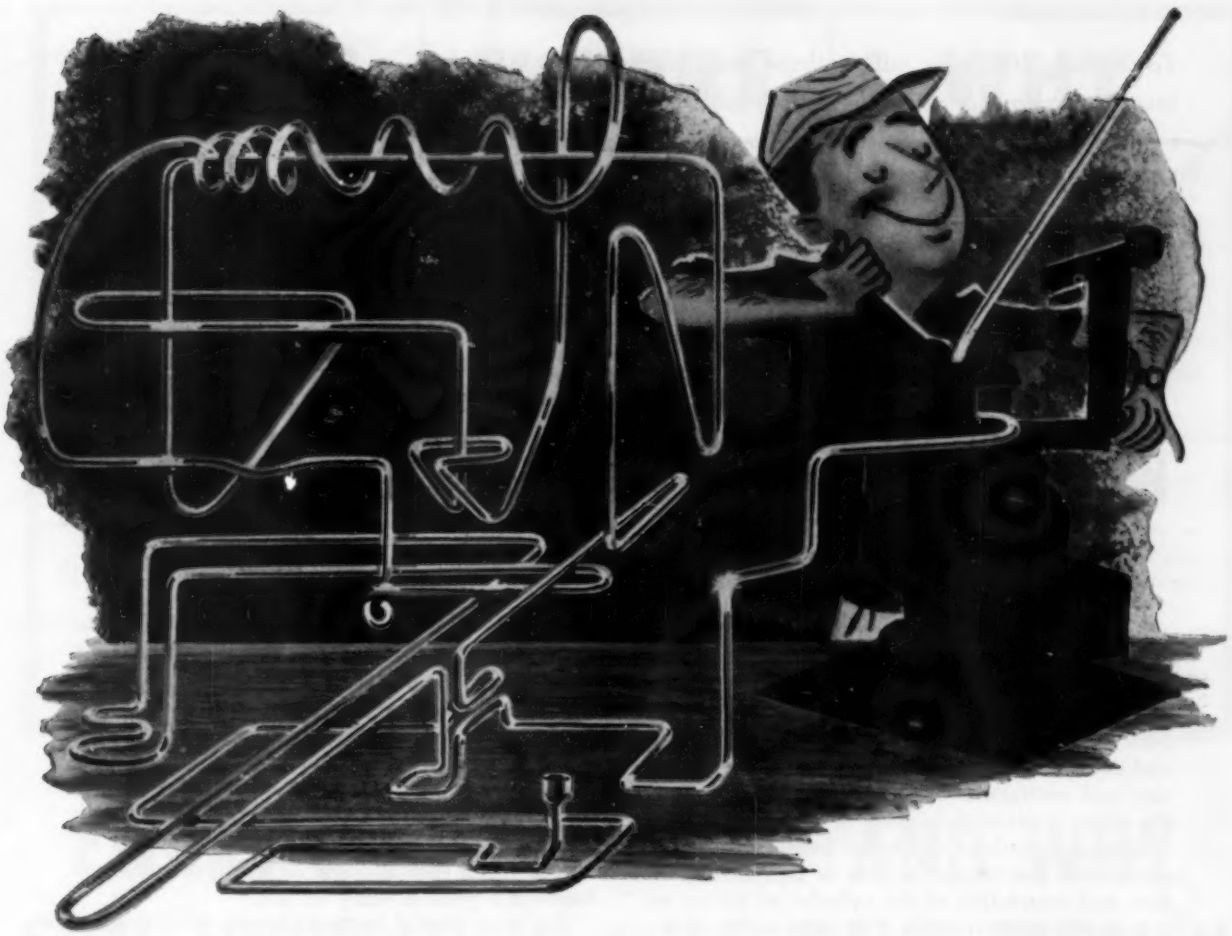
These non-adjustable valves would cost less than an adjustable valve with a lock.

Elimination of adjustable pressure control valves will be a severe blow to many "knob-turning-happy guys." Trouble-shooting would be simplified. Machine operation would be more uniform and often safer.

"No, let's have control handles, we need them to adjust for different jobs."

While an adjustable valve would have more parts than a non-adjustable valve, it may well cost less because most non-adjustable valves would have to be specially made for a given application. It isn't economical to make a different valve for each machine. The only virtue of the non-adjustable valve is the elimination of tampering. This non-tamper feature can be had with adjustable valves equipped with a lock. All relief valves presently being made to J. I. C. standards can be locked. If adjustable valves are bothersome, they can be put in a locked cabinet. Gasket mounted valves make the use of a cabinet very practical.

Availability of pressure adjustment permits the user to compensate for changes in the work. He can also reduce heat and wear and power requirements by operating at low pressures when the work permits. The user of an adjustable valve need not carry a stock of precalibrated springs or several different fixed relief valves. ▼▼▼



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HYDRAULIC TUBING • SPECIAL TUBING • MECHANICAL TUBING • DIESEL TUBING • PRESSURE TUBING • AIRCRAFT TUBING

To properly drill, turn, mill or shape metal, the work or tool slides must feed smoothly while the cutting tools are working. Development of feed circuits to power machine slides has come a long way since the days when hydraulic applications were limited to jobs calling for brute force. But users find that even with the best feed circuits they may encounter irregular feeds.

What to do about JUMPY MACHINE FEEDS

• **Get at the cause**—Assuming, for the moment, that feed control valves are functioning properly and that all mechanical bugs in the slides have been eliminated, we can point to the compression and expansion of the hydraulic fluid or the expansion and contraction of the cylinder or piping as the causes for irregular feeds.

Having a machine which has been properly designed, the user should be able to rule-out expansion and contraction of the cylinder or piping as a cause of his feed troubles. That is, he can cross-out this possible cause, if he is operating the machine at the load for which it was designed.

Now we've simplified our trouble-shooting problem, by saying that the machine builder couldn't have used cylinders with improper wall thickness of fluid lines which are too light for the working pressure. The user has the problem of jumpy feeds and all the causes except a "spongy" fluid have been checked out.

• **Air gets trapped**—"Spongy" action is almost a sure sign of air having been trapped in the oil. The air compresses and expands with variation of load to cause the jumpy feed. The machine designer can do a lot to keep the system free of entrained air. Wherever possible, all cylinder ports should come out the top side of the cylinder. If the cylinder is horizontal, ports should come off the top of the periphery. If vertical, one port should come out the top end and, of course, the others cannot. The air accumulates at the top side of the cylinders when the machine is at rest. With the ports at the top, the oil when circulated, will automatically carry off the accumulated air, since it is not trapped as it would be with the ports part way down on the cylinder.

In some cases it is not possible to have the ports on top of cylinders or the circulation of oil back and forth through the cylinders is not sufficient to carry off the air. In these cases, it is necessary to put vents or air bleeders at the places in the system where air tends to accumulate.

The use of air bleeders has often been troublesome. There are very few reliable automatic bleeders which will work for all systems. The manual bleeder works well enough for most machines—but it does require attention. And, when the bleeder is not intended to be open, it must be tightly seated or it becomes a point of entry for air.

Air vents should be opened only when there is pressure at that part of the system. This is particularly true in systems where the cylinder is above the oil level of the hydraulic tank. In such systems where the cylinder is a number of feet above the tank oil level, the head of oil will tend to suck air through the cylinder packings, vents and fitting connections when the machine is idle. An air vent in such a system, if not tight, can let air into the system without showing an oil leak. Sometimes a back pressure valve is placed on the discharge lines to overcome the static head of oil.

In some systems a common line is used as a discharge for two or more different cylinders that operate at different times. In these systems a venturi effect is sometimes set up across the tee when one cylinder is operating and tends to suck the oil from the other cylinder line. If this line and all connected to it are not tight, air will enter to take the place of the oil that is sucked out.

A good hydraulic oil will resist mixing with air. An oil which has a poor demulsibility number will not readily free itself of entrained air. Therefore, one step which the user can take to reduce jumpy feeds is to select an oil with a good demulsibility number.

• **Oil will compress**—Today, with a great many machines using pressures in excess of 1000 psi,

WHAT	WHERE	WHY
SUNVIS 900	**In tight systems** where oil is rarely changed and little or no make-up is needed.	**Exceptionally long life** of oil keeps overall costs low.
SOLNUS	**In tight systems** where make-up oil is less than 5% per month.	**Moderately priced**... excellent stability and rust protection.
SUNTAC	**In leaky systems** where make-up average is 5% or over per month.	**Reduced leakage** in systems cuts oil costs and downtime.
CIRCO	**In systems** where oil is continuously diluted by water, cutting fluids and other contaminants.	**Low-priced**...excellent protection where oil must be changed frequently.
SUNVIS H.D. 700	**In systems contaminated** by dust and deposits of sludge, varnish, etc.	**Cleansing action** removes deposits and eliminates costly teardowns.
LUBEWAY	**In dual purpose systems** of machine tools where hydraulic oil is also a way lubricant.	**Added film strength** of this hydraulic oil also eliminates "stick-slip" on ways.

CHART SHOWS WHERE AND WHY SUN HYDRAULIC OILS SAVE MONEY

As the chart shows, to operate your hydraulic system at maximum efficiency and minimum cost you must consider the condition of your hydraulic system, as well as pressures, operating temperatures and other usual factors.

And, very important, you must consider the age of your system. Continued use of original oil recommendations can be costly. A change in the type of oil can often result in substantial savings...especially where systems have developed leaks or where sludge and varnish cause excessive maintenance.

For complete information about how Sun hydraulic oils can help you cut operating costs of your hydraulic system, see your Sun representative...or write SUN OIL COMPANY, Philadelphia 3, Pa. Dept. AH-9.

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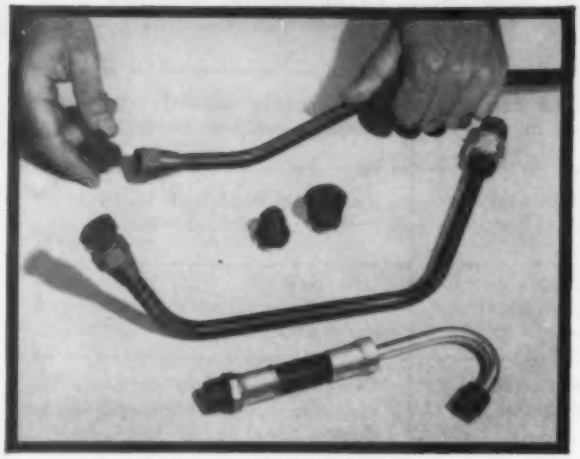

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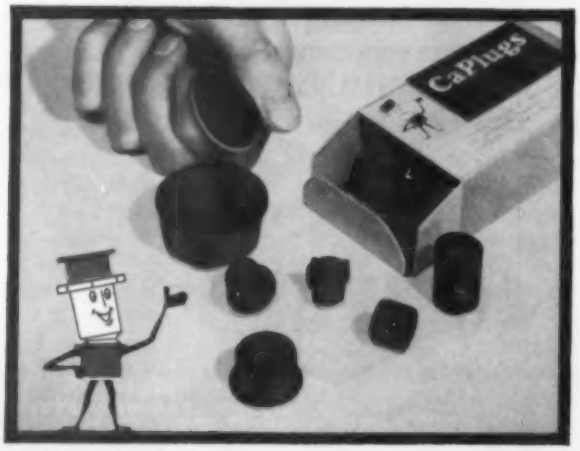
find out by writing for this FREE assortment



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PROTECTIVE CLOSURES CO., INC.

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compressibility of the fluid takes on real importance. As pressures increase, the old "axiom" about fluids being incompressible becomes a myth. Compression of oils is enough to cause trouble on certain machines. For example, a six foot long column of hydraulic oil of 150 SSU at 100 F will compress approximately ¼ inch under 1000 psi pressure. This compression is approximately in direct proportion to pressure up to 2000 psi.

• **Check mechanical friction loads**—Suppose a machine has a jumpy feed which develops whenever the feed rate is adjusted to a very slow rate, say anything below 1 inch per minute. This jump develops when the machine is operating without doing work. The air has all been bled from the system and the oil in the tank is free from air bubbles. It must also be assumed that the hydraulic system has been properly designed and meets the minimum volume requirements of the feed pump or metering valve manufacturer. Then this irregular feed is the result of compression and expansion of the hydraulic oil caused by an irregular friction load.

The machine should first be checked for some unnatural friction load such as clamps or gibs being too tight on the traveling head ways. The cylinder might be out of line with the traveling head so that it tends to bind the piston rod. The packing on the rod itself might be too tight or the piston rings might have been fitted with too little clearance. If all these things are checked and the jumpy feed continues to take place, it is probably due to the natural difference between static and moving friction. This is more apt to be true if the moving machine part is heavy and moves on a horizontal plane. When the rate of feed is below one inch per minute, the coefficient of friction tends to vary between the coefficient of static and moving friction. If the machine part weights 10,000 lbs and the static coefficient of friction is .3 and the moving coefficient is .15, it will require 3,000 lbs to start the motion and 1,500 lbs to keep motion going at a reasonable rate.

With a 6 in diameter cylinder, having an area of 28.3 sq in, the pressure required to overcome static friction is 3,000/28.3 or 106 psi. The pressure required to overcome moving friction is 53 psi. This means that when traveling at 1 in per minute or less, the pressure must build up to 106 lbs and the oil in the cylinder is compressed. Then, when the head begins to move, the pressure required drops to 53 lbs. The tendency is for the oil to expand and move the head faster than the metering valve or feed pump can furnish it to the system. As a result, the head jumps forward rapidly, then waits for the oil to again be compressed to the 106 lbs. If the column of oil behind the piston is 4 feet long, an anticipated jump of about .009 of an inch could be expected from the friction caused by weight. The friction of the piston rod, gibs and clamps as well as the in-

ability of metering or pressure valves to function properly under these conditions tend to multiply this jump.

In order to correct a jumpy feed under these conditions, it is necessary to make the static coefficient of friction approach the value of the moving coefficient of friction. This can sometimes be done by cutting down on way contact area and by providing a pressure lubrication system so that the machine part actually rides on a complete oil film. At other times a change in way lubricant may give the desired smooth feed. A larger cylinder, of course, will tend to cut the difference in pressure and will reduce compression.

• **Cutters can cause jump**—Sometimes a chatter is set up in a machine tool when the cutter contacts the work. This might be caused by the cutter tending to pull itself into the work at a rate greater than the feed rate, thus making the feed irregular. If this tendency is not too great, it can be corrected by setting up the back pressure on the feed cylinder. In some cases, it might be necessary to change the angle of the cutters.

During facing operations on machine tools, a chatter is often set up as the facing tool cuts itself clear when the head contacts the positive stop. This is often caused by the stop tending to spring under the hydraulic force as it is transferred from the work to the stop. The best correction for this is to build the stop so that it cannot spring. ▼▼▼

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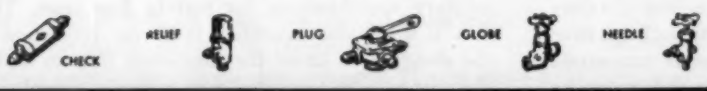

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Reliability of components in aircraft hydraulic and pneumatic systems always heads the list of what the user wants from the component manufacturer. To build "reliability" into a pump or valve the designer must be able to line up the requirements in order of their importance. Before he can do so, you as the user must . . .

SUPPLY CORRECT OPERATING SPECS

IT takes careful analysis and often an unusual amount of foresight to establish specifications for aircraft components. To throw a whole book of specs at the supplier in an effort to cover every contingency is as bad as supplying inadequate specs. In a talk before an SAE National Aeronautic Meeting, J. W. Kelly, Adel Division, General Metals Corporation gave examples of some of the hidden factors which are disclosed by a detailed analysis of the operating requirements. These factors play a large part in designing reliable units.

Leakage: Almost invariably standard rates pertaining to leakage are specified. It is necessary, however, when defining leakage requirements to ask some very critical questions. If a low leakage rate is given, then there should be set forth the reasons for it being held close. The effect of temperature on leakage should also be evaluated, for leakage increases as the temperature increases. Time is also an important factor in leakage. Many valves have the characteristic of diminishing leakage over a period of time. Therefore, if one is concerned about the loss in oil volume through a slide valve, he should consider the leakage as being over a period of time. In addition, if there is concern about thermal expansion and a slide valve leakage rate is being used to eliminate the need for a thermal relief, make sure that the slide valve will not eventually dam up and thus nullify its thermal protection. An interesting case pertaining to thermal expansion leakage and one which brings out another important point occurred in an application where the cylinder port in a slide valve was sealed from return and pressure ports by individual lands. The customer expected the valve, through its leakage from the cylinder port to return, to take care of thermal expansion. However, in the field he found that such was not the case because the pressure port leakage to the cylinder port occurred at a much greater rate than the leakage from cylinder port to return, thus permitting the cylinder line pressure to build up sufficiently to inadvertently operate the cylinder locks.

Flow capacity: The flow normally specified for a hydraulic component is the rated flow listed in the military specifications for certain line sizes. This flow is invariably exceeded. It is very important to the designer to know the maximum flow to which the unit is to be subjected. For example, actual tests on a 6 gpm relief valve showed that it was capable of handling at least twice rated flow. Service ex-

Say, Walter, which actuating system works best at **HIGH** temperatures?

Whatever the temperature—from a roasting 250° to a frigid—65°, pneumatic systems *always* give fast-acting, dependable performance! Because viscosity of the air used in pneumatic systems remains essentially the same over an extremely broad temperature range, the systems are *never* sluggish!

Pneumatic systems are weight-and-space savers, too! Smaller lines are used, and *no* return lines are required. What's more, you actually *store* energy from a lightweight, low-horsepower compressor, eliminating the need for a heavy, high-horsepower source!

With pneumatic systems, leakage is no serious problem. The compressor itself automatically compensates for any minor leaks which might occur. Nor is there any danger from fire with pneumatic systems, since the air used in the systems cannot burn!

We here at Kidde have a *complete* line of pneumatic system components, as well as facilities for engineering complete pneumatic systems. If *you* have a problem in pneumatics, please write us.

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perience showed, however, that in one application flows were actually reaching a peak of 35 gpm, and in some instances were causing the piston to surge enough to allow the O-ring to extrude beyond the shoulder. If the designer had been aware that the flow would go this high, he would undoubtedly have tested for the condition and thereby would have discovered the potential difficulty.

Slide valves are invariably statically balanced. However, under dynamic conditions this balance is not always maintained, and unless they are tested to the actual maximum flow conditions, it may be discovered, after the valve is functioning in the airplane, that it will refuse to open or close if the dynamic conditions cause an unbalance greater than the operating forces.

Pressure range: Operating pressure is normally given as a rated pressure of 1500 psi or 3000 psi. This is normally considered as a maximum and thus a most critical operating pressure condition. With the wide usage of pilot-operated valves of today the minimum operating pressure has become important because in many cases the pilot valve is balanced against the operating pressure, and the greatest operating forces occur under conditions of minimum pressure. It is therefore necessary, when considering pilot-operated units, to think in terms of operating pressure range.

Back pressure: Back pressure is also a neglected item. A shuttle valve that was fully tested per the military specification, and successfully passed all the test conditions and received qualification approval failed because of back pressure. In this design, the O-ring which forms the main seal on the shuttle passes through an enlarged opening. Before it moves into or away from this opening, the lands on each side of the O-ring serve as slide valves and shut off the flow that could cause damage to the O-ring. In the field, however, one customer found that he had high enough back pressure in his system to cause damage to the O-ring. Needless to say, the military specification was changed to include this condition, the shuttle valve had its qualification rescinded, and its use was discontinued.

Co-functioning condition: The co-functioning of a hydraulic component with the rest of the system is a factor seldom considered by the component designer. This is not due to his unwillingness to consider co-functioning, but is because he lacks information pertaining to the component's environment. To take full advantage of the designer's ability, information should be given on at least the portion of the system in which the unit fits: What does it control? How does it operate? What is it expected to do? Many other questions are asked by the designer for which he should have the answers. Simple items such as the shaft end of the valve can cause extensive difficulty when the designer considers it as being subject to normal loads, but after the valve is installed, finds that it is being greatly overloaded. Manual overrides on switch type solenoid valves would in many cases be of different design if the designer knew that the airframe manufacturer was going to latch that manual override and then attempt to operate the valve in the opposite direction by the solenoid. This condition has caused countless solenoid burnouts.

Continued on page 106

TABLE I

GENERAL DATA	HYD. & PNEUM. DATA	ELECTRICAL DATA
Directional Control Valve Way No. of ____ Valve Positions____ In Neutral Position Cyl. Ports To Be Blocked To Ret. ☐ Open To Ret. ☐	System Press.____ Press. Drop____ Rated Flow____ Operating Press. Range____	Voltage Range____ Max. Amps.____ Type of Actuation Sol. Oper. ☐ Motor Oper. ☐ Is Pilot Oper. Allowed Yes ☐ No ☐
Shutoff Valve Normal Open ☐ Normal Closed ☐ Hold One Way ☐ Hold Two Way ☐ Flow One Way ☐ Flow Two Way ☐	Leakage Rate at 90°F. & After 3 Minutes Normal Pos.____ Oper. Pos.____ Ambient Temp. Range____To____°F. Line Size____ A.N.D. No.____ Fluid Type & Spec. No.____	Actuation Speed On____ Max. Min. Off____ Max. Min. Electrical Connector____ Cont. Duty ☐ Int. Duty ☐
Manual Control Motion Rotating Shaft ☐ Rotating Lever ☐ Push Pull ☐ Handle Load____ Handle Travel____	**Relief or Check Valve** Flow Rate____At____PSI Crack Press.____ Reseat Press.____	Is Operation Req'd. at Min. Voltage After Heating at Max. Voltage? Yes ☐ No ☐ If Yes Max. Ambient Temp. is ____°F. & Oper. Press. is ____PSI Max.____PSI Min.

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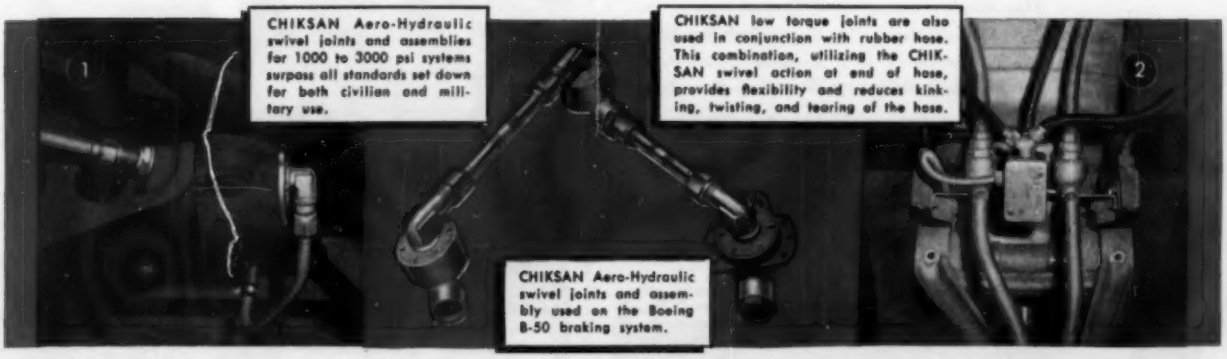

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Environmental test conditions have a complete listing in the military specifications, and should definitely be specified when applicable. However, it has happened all too often that the specification writer has chosen to list all the environmental conditions whether applicable or not, on the theory that by so doing, he has covered himself against all possible contingencies. It would be far better to spend the time necessary to thoroughly analyze the specific application and set forth conditions to prove the unit capable of meeting the actual requirements, rather than cluttering the picture with many unnecessary tests. A good example of this is a single coil, solenoid valve specification which requires altitude and radio noise tests. These tests had no bearing on the specific unit involved, whereas, on the other hand, inadequate vibration tests listed in the specification were conducted and did not cover the actual condition, the valve being installed in a location subject to very severe vibration conditions.

What specific data should you supply? As a starting point, Table 1 gives a check-off list for typical aircraft valves. This table is part of a standardized form used by Adel. Of course, the filled in blanks do not complete the picture.

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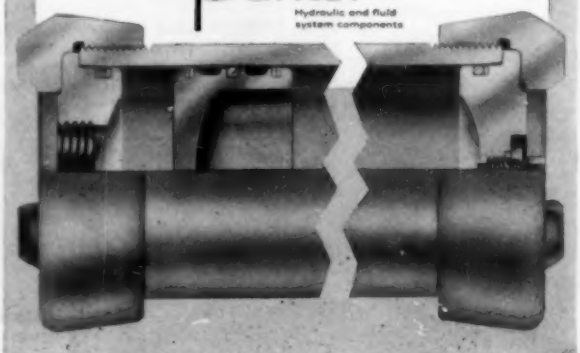

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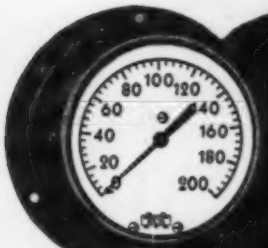

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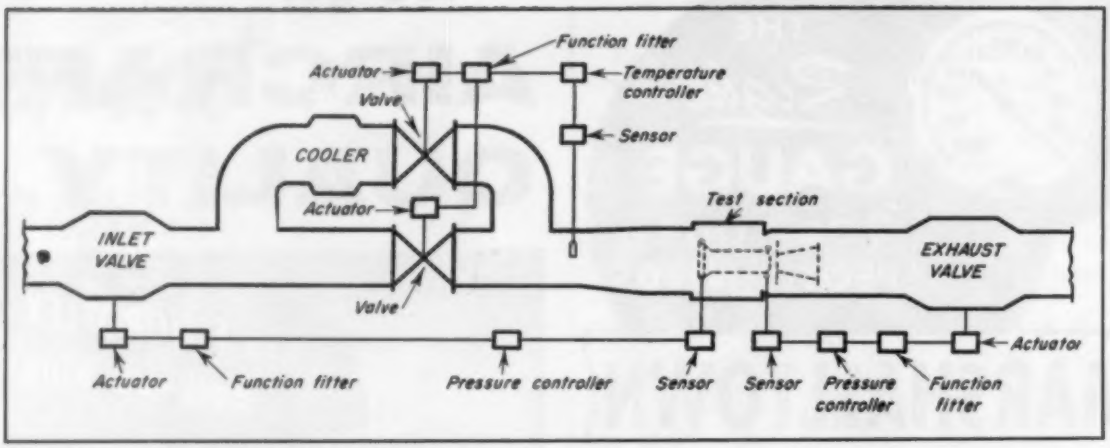

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ENVIRONMENTAL test chambers for jet engines must simulate the various air conditions which exist during actual in-flight operation. CDC Control Services, Inc. of Hatboro, Pa. was called upon to design a facility which would permit accurate control of ambient air temperature and pressure surrounding the engine, and control of the inlet and exhaust conditions. The control system for this installation was particularly different because of the following:

1. Ramp changes of airflow through the test engine required the pressure control valves to stroke in one second or less.
2. The wide range of flow rates and pressures required an optimum control function to maintain stable control.
3. The required accuracy of control necessitated a system with high resolution and frequency of response.

Some of the important factors involved were location of valves, size of lines, valve characteristics, actuator speed, accuracy, and frequency response.

To establish an optimum system design, an analog computer study, together with a mathematical analysis of the system was required. To check the performance of the controls, actuators, and valves, a model was built scaled to 1/100 actual size. The scaled down volume, valve, and air flow agreed favorably with the dynamic response times calculated in the preliminary analog studies.

DETERMINATION OF VALVE CHARACTERISTICS

In the past, a common practice of purchasing valves apart from the rest of the control resulted in poor performance and, in many cases, control had to be manually operated to gain any use from the facility. This overburdening of test operators with details that should be automatically maintained often produced poor test data.

Under normal operation of the test cell, the control valves are required to maintain a fixed pressure with varying air flow. Therefore, under most operating conditions, the pressure drop across the valve is constant. To keep the overall gain of the valve constant, a linear valve characteristic design is indicated. In addition, the range of flow variations require a valve with a range of at least 100 to 1. Unfortunately, linear valves usually have small range due to poor operation at the closed end of the stroke. Thus, it is better to use a non-linear valve characteristic such as the equal percentage or logarithmic characteristic to achieve maximum range. A function fitting device alters the controller output to minimize the overall gain change in the closed loop control system.

The valve used in this application is a sleeve valve. The characteristics of the sleeve valve depend on the shape of the air passages in the valve. Making a logarithmic or equal percentage charac-

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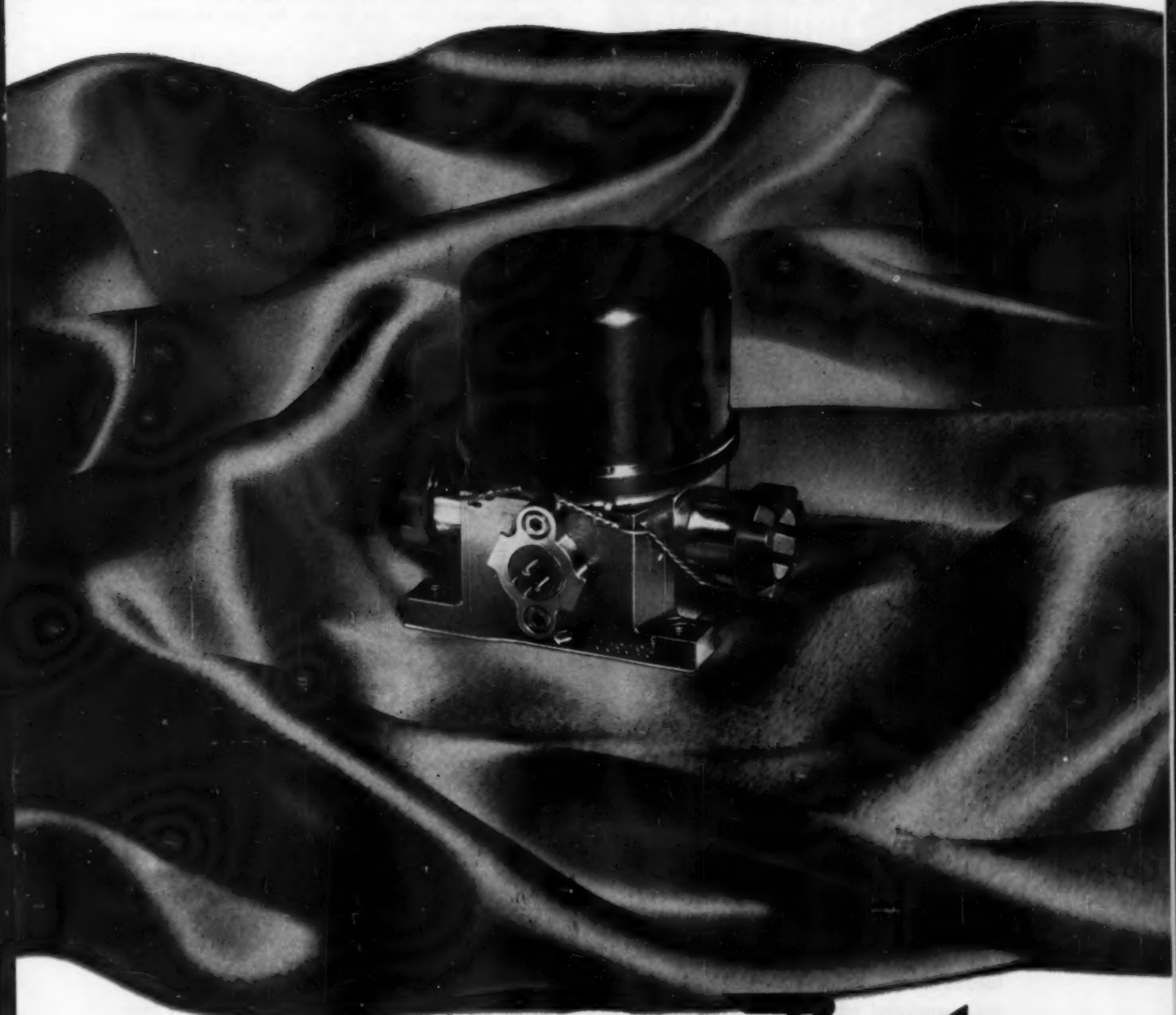

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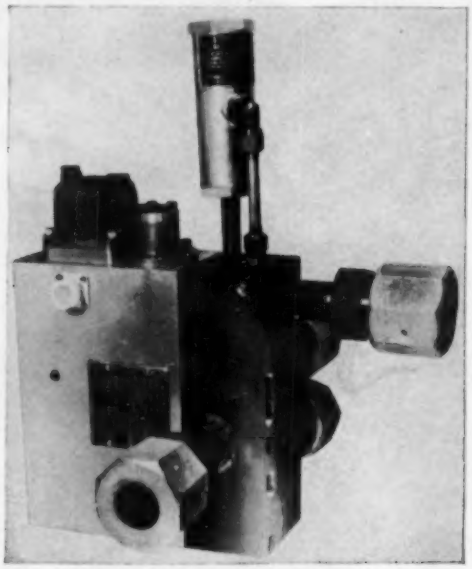
teristic valve was found very expensive. Since a function fitting network was to be used, the best practical compromise in valve stroke, size, and cost was found to be a square-law valve with triangular air passages. The square-law allows wide range. Also the function fitting device (either electrical or mechanical) can be used to convert the controller signal versus valve flow to any designed characteristic from linear to logarithmic.

Because of balanced design of the valve, the aero-



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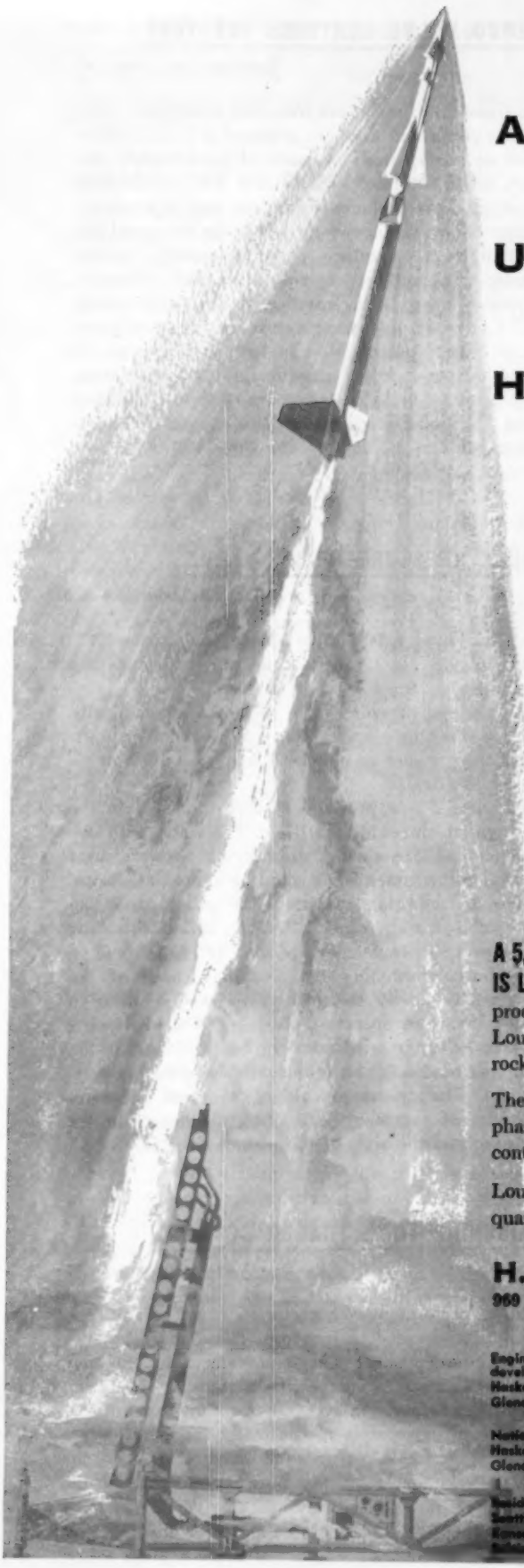
dynamic forces cause very little unbalance in the valve. The major portion of the power required for valve operation is needed to overcome static friction and accelerate the mass of the sleeve. The unbalanced aerodynamic forces on the sleeve approach a minimum at about 1/3 of the valve stroke open. Therefore, the horsepower and operating mechanisms are only a fraction of that normally required for butterfly or other valve operation at equivalent speed and frequency response.

ACTUATOR

The actuator consists of a hydraulic servo positional potentiometer, servo amplifier, and a high pressure hydraulic cylinder. The servo positional system is capable of a stroking speed of one second, maximum resolution of one part in 1000, and a frequency response of better than eight cycles a second under maximum load conditions.

In developing the proper control system for en-

Continued on page 112



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2"	26.24	27.88	28.32	28.76	29.64	30.52	31.40	32.28	33.60
2½"	27.36	34.12	34.68	35.24	36.36	37.48	38.60	39.72	41.40
3"	33.04	37.28	37.92	38.56	39.84	41.12	42.40	43.68	45.60
4"	40.84	43.68	44.52	45.36	47.04	48.72	50.40	52.08	54.60
4½"	48.96	51.92	52.88	53.84	55.76	57.68	59.60	61.52	64.40
6"	66.60	70.80	72.20	73.60	76.40	79.20	82.00	84.80	89.00
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SERVO VALVE CONTROLS JET TEST

Continued from page 110

gine test facilities where transient conditions simulating climb and dive are required it is imperative that an analog study be made of the complete system to obtain most economical and satisfactory control. This includes exhauster and compressor surge controls, volumes up and down stream of the test engine, temperature control equipment, engines under test, and the control valves and actuators. Systems have been installed using programmed inlet pressure, inlet temperature, and exhaust pressure control points. Modern test facilities can set their temperature and pressure in advance to accuracies of ½ to ¼% under steady state conditions and 1% under transient conditions, and these settings will be maintained for the duration of the test. ▼▼▼

DUAL PRESSURE RELIEF VALVE

Continued from page 81

required and acts on the spring and piston "C" through "B", a ¼ inch dowel pin, to reduce the pressure to 60 psi.

This dual pressure valve is shown schematically in the machine circuit, Figure 4. Tests have shown that the pressure on clutches C4 and C5 are now almost identical.

Figure 2 is a proposal of a further step in the design which could be utilized. The valve, with one piston and one spring, discharging two pressures through the same orifice could be altered as shown. Here the addition of piston "D" would give two available spring forces. Allowing oil to enter the end port, 3, would move piston "D" to the end of its bore, shortening the working length of the spring to increase the spring force, and resulting in an increase in operating pressures. The two spring forces when coupled with the two different piston areas would result in four available operating pressures. The actual psi values of these pressures would, of course, depend upon the design of the spring and the sizes of the pistons selected. ▼▼▼

MACHINE TOOL TRACER CONTROL

Continued from page 90

three performance characteristics: sensitivity, stability, and speed of response. These characteristics are interdependent and improvement in one may mean sacrifice in another. By making the operating cylinder larger, the system can be made more sensitive to movements of the tracer finger. However this is accomplished with the sacrifice of speed, the larger cylinder requiring more time to act with the same oil flow. Sensitivity can also be increased by changing the leverage of the tracer unit to give greater movements of the valve for a given move-

ment of the finger. However the system can become so sensitive that it is no longer stable. Thus in designing tracer circuits, the engineer must constantly make the compromise in sensitivity, stability, and speed.

APPLICATIONS OF TRACER CONTROL

Tracer control has been successfully applied to machining complex parts, and the accuracy of this method has produced greater output with less scrap. A particularly useful application is for screw cutting. Normally screw cutting requires skill in withdrawing the tool from the thread at the end of the cut. To simplify this withrawal, the tool is usually withdrawn at a low speed, so that a relatively long time is available for disengagement of the leadscrew. With tracer control the tool can be withdrawn immediately by contact of the tracer finger with a shoulder on the template. This permits cutting screw threads to a shoulder on the workpiece, an operation that is not possible with manual control. In addition, much higher cutting speeds can be used. By using a suitable template it is possible to cut taper threads with a single point tool. Tracer control is especially applicable to the aircraft industry where a typical operation is machining integrally stiffened wing structures. In a die sinking operation tracer control has been applied to a vertical milling machine with the results of greater speed on both internal and external work. Among other machine operations adaptable to tracer control are milling, planing, profiling, shaping, and cam turning. ▼▼▼

MULTI-SPINDLE DRILLING & TAPPING

Continued from page 84

flexible and of sufficient length to allow the whole insert to be pulled out of the tank—even while in operation—to be easily serviced. This complies with accepted better practice and to J.I.C. specifications.

Tapping is done with a lead screw which operates from the drill head. When only a short stroke is used, no hydraulics are necessary. When it is necessary to use a long stroke—to provide clearance for loading, hydraulic feed is used.

The lead screw is driven from the tapping head the same as a drill spindle. It is contained by a forged bronze lead screw nut mounted on a bushing plate. The tapping head and the bushing plate reciprocate with the action of the piston on guide rods contained in the locating fixture.

When the piston drives the bushing plate to a point where tapping is to start, a limit switch turns on the lead screw motor. At the same moment, the bushing plate comes in contact with a rigid stop. It is clamped in this position by hydraulic force, (determined by relief valve setting), while the tapping cycle is completed. After tapping the piston pulls the whole assembly back away from the job. ▼▼▼

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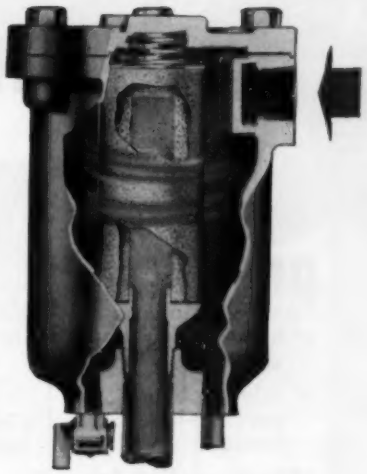

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Abstracted from a paper delivered in April 1955 by W. E. ELDRED *Engineering Manager, Bendix Products Div., Bendix Aviation Corp. to the National Fluid Power Association.*

TRENDS IN AIRCRAFT HYDRAULICS

• By W. E. Eldred

Because of increasing complexity of modern aircraft, hydraulics has developed rapidly since the beginning of World War II. Landing gear, cargo doors, flaps, a-c generators, gun turrets and other equipment require the control and force available with hydraulics.

Although the general components for aircraft hydraulics are the same as those for industrial applications, the design and construction is much different because of weight, space, and performance requirements.

FLUIDS

Present hydraulic fluid is generally a mineral-base oil with temperature range of −65°F to 275°F. Some good fire-resistant fluids have been developed for normal temperature ranges, but the increasing speeds of aircraft and missiles are forcing development of higher temperature fluids. Currently two silicate ester base synthetic fluids appear to be suitable for 400°F service and for short service life at about 550°F on missiles. The problem on a high-temperature airplane is cooling the hydraulic fluid. Use of the fuel as a coolant is one possibility, refrigeration is another. Ambient air cooling is the simplest and lightest method, but nearly all parts of the hydraulic system must work at abnormally high temperatures.

SEALS

Aircraft packings are almost universally O-rings with only a few exceptions such as cups in master cylinders and a few other parts. Suitable compounds have been worked out to give satisfactory life over the normal temperature ranges of standard mineral-base fluid. For higher temperature ranges, no packings have been qualified to meet 400°F. Several approaches to the high-temperature problem are (1) elimination of as many packings as possible, particularly in regard to moving seals; (2) new materials such as the silicones and the fluorine base materials; (3) metallic packings; (4) lap fits or labyrinth-type seals with return drain lines.

PRESSURES

Pressure is generally 3000 psi, but only recently has a complete line of reliable components and packings been developed for this pressure. Many studies have been made to see if significant weight savings will be made by going to higher pressures. A study made on a current supersonic bomber showed a 15% saving in overall system weight by going to 5000 psi. Higher pressures also offer significant space savings which is becoming a critical factor on the high-density aircraft now being developed.

LINES AND FITTINGS

In the 3000 psi range, quarter-hard stainless steel tubing is generally used. The common arrangement is to use steel for the pressure lines and aluminum alloy for the return lines. Even in low-pressure systems, if piping is subjected to undue pulsation or the possibil-

ity of external damage, more rugged steel is employed. Sizes range from ⅛-inch, .018-inch wall stainless for gage lines, to 2-inch, aluminum overflow lines. Double flaring of the tubing is often used in sizes below ⅜ inch. Fittings are the AN standard type in most cases, although recently a trend toward flareless fittings has been made. The primary advantage of the flareless fitting is to eliminate considerable work on the part of the service crews in the field when pre-formed tubing spares are not available.

PUMPS

Pumps are either the gear type or the axial-piston type with the latter being used more with increasing pressures. Developments in radial-piston pumps make this type more important at higher speeds. While 3750 rpm has become almost a standard drive speed, work is being done with speeds up to 10,000 rpm in the interest of space and weight saving. The majority of aircraft pumps have constant displacement. However wide usage is being found for the variable volume pump because of power and heat economy. Problems in the pump field are: increasing size, need for improved volumetric efficiencies, higher temperatures, and improvement of life and reliability.

PUMP DRIVES

Pumps are usually driven by the main power plant. However other drives are auxiliary power plants and air turbines that are supplied from the main jet engines or auxiliary power units. The air turbine drive is a significant trend, particularly for large aircraft. It is able to transmit power over long distances with light weight.

VALVES

Valves are usually tailored to fit the requirements of the particular system on which they are used. Valves used in surface control systems have particularly stringent requirements. With oil flow up to 25 gpm, they must form a stable component of a servo system, giving precise positioning without chattering or malfunctioning.

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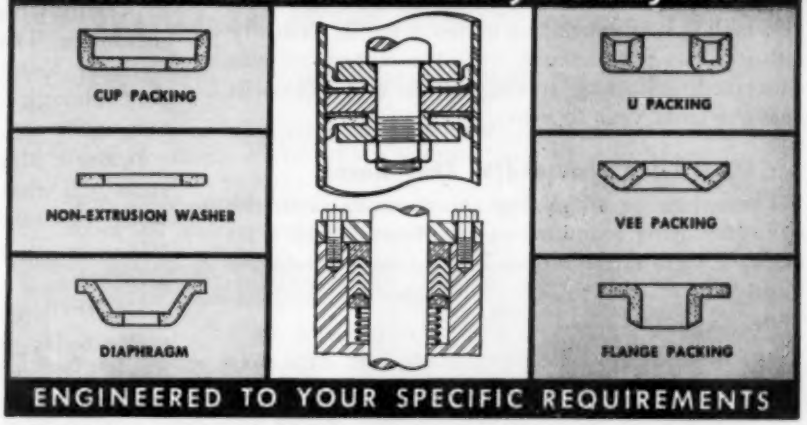

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(Advertisement)

Report to Cylinder Users . . .

Here at Miller Fluid Power we have a pattern which we follow. A goal at which we are shooting. The pattern isn't too simple. And the goal isn't an easy one. But we've been making progress. Our position right up in the van of the industry proves that.

Our job is the production of cylinders. Basically, there's nothing anyone can do to alter a cylinder. It was old a hundred years ago. It probably won't change basically in another hundred years. But in the details of the cylinder, change is the major element.

Which is very much like industry itself. Basically industry has not changed since free enterprise was conceived on this continent. But in every detail it changes from year to year.

It's the Thousandths That Count

There was no single big thing wrong with the cylinders being manufactured yesterday. Just a lot of little things. So Miller Fluid Power made the improvement of little things its business.

We experimented with new materials and made safer, more dependable steel heads and caps. We hard-chrome-plated 110,000 PSI yield point steel to improve radically the piston rods. We raised the efficiency of operation to new peaks. Striving for quality in the smallest detail we improved in a dozen parts which are hidden from sight.

For instance, most cylinders leaked in operation. Miller made one that wouldn't leak. To prove it, we went away out on a limb and guaranteed leak-proof operation. And made the guarantee stand up.

We Learn by Listening to You

We saw our customers as thousands of men in thousands of shops wrestling with thousands of production problems. We made those problems ours and produced cylinders to whip those problems. Maybe we didn't revolutionize the cylinder business in the process. But we sure helped. We know that.

We learned to produce what we believed was the best cylinder on earth. We also learned that the best cylinder today wouldn't be good enough tomorrow. So, with the good one in production, we listened some more, experimented, and came up with a better one.

Miller Fluid Power is a young company in an old field. We are young, progressive, and willing to listen. We innovate without being prodded.

Discussion is a Two Way Street

On occasion we like to have others listen to us. Especially when what we have to say will help our customers. That is the idea behind our College of Cylinder Knowledge. We know a lot about cylinders. Though not as much today as we will tomorrow or the day after.

In our College of Cylinder Knowledge we try to show you what good cylinders can do for you. And what you should demand in any cylinder you buy. We meet other men who know what they want in a cylinder. We listen to their wants and try to explain what perfection in detail means.

We believe that when the users of cylinders sit down across the table from the producer who is trying to make the best, better cylinders result.

We'll be carrying that belief into the Production Engineering Show at Navy Pier in Chicago on September 6. Our College of Cylinder Knowledge booth will be open for that kind of discussion. We'll listen and learn.

The only way we can learn is from you. We can help you. But not until you've dropped that problem of yours in our lap. Your problem contains the stuff of which the better cylinder will be made. The cylinder that will have that quality plus which we like to think is the stamp of Miller Fluid Power.

Remember this when you see the sign over Booth 1819-23. We'll be there to listen to your suggestions, demands and questions. Also, because we are in the cylinder business, we'll be there to show you a cylinder you will want to buy.

Frank Flick

President

MILLER FLUID POWER COMPANY

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Production Engineering

NAVY PIER SHOW CHICAGO

AIRCRAFT TRENDS

Continued

RESERVOIRS

A typical aircraft reservoir is a welded magnesium or aluminum tank, usually incorporating a filter on the inlet through which all the hydraulic fluid is circulated. Some work has been done on fiberglas plastic reservoirs. The reservoir is usually vented to atmospheric pressure with an overflow line of sufficient capacity for large surges. There is a definite trend, however, towards closed hydraulic systems, particularly in planes designed for high altitude. These systems have a reservoir pressurized to about 50 psi. This reduces oxidation of the fluid, keeps air in solution, prevents water from getting into the oil, and prevents starving the pump. Pneumatic, hydraulic, and spring pressures are all being tried as power sources for pressurization.

ACCUMULATORS

The spherical type accumulator is being replaced by the cylindrical or piston type. The latter eliminates the large bladders or diaphragms and has a shape that is more easily stowed in a typical airplane structure. Transfer of air in any quantity to the hydraulic side of an accumulator can cause many systems to malfunction, and this has been a minor problem with both types of accumulators.

LANDING GEAR APPLICATIONS

In landing gear struts for nose, main, and auxiliary gears, strokes as high as 30 inches and drop heights as high as 180 inches have been used on Navy fighters. Individual struts supporting over 200,000 lb. are in use.

CYLINDERS

For weight saving much use is made of aluminum alloys for rods, pistons, and cylinders. A spherical-type ball bushing is usually used at both ends to eliminate binding. Considerable use of hard anodizing is being made in aluminum cylinder components, and chrome plating is frequently used on single actuating jacks where corrosion due to condensation of atmospheric moisture is encountered. Considerable use of internal, collet-type locks is being made on hydraulic cylinders, as opposed to the previous practice of having external locks. This is undesirable from the standpoint of trouble shooting, and requires very close tolerances. However, the advantage of using the actuating cylinder as both structural member and locking device, eliminates many parts.

HYDRAULIC MOTORS

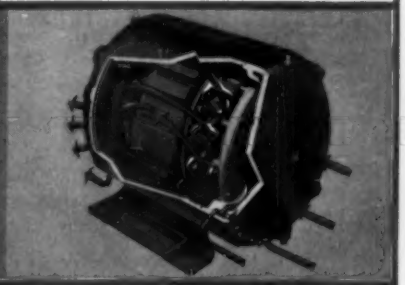
As in pumps, the gear and axial-piston type motors are predominant. Hydraulic motors are capable of delivering a large amount of power within a small light package. The amount of torque available is proportional to displacement and the pressure applied, and is independent of speed. Hydraulic motors have low internal inertia and may be rapidly accelerated and easily controlled. Typical aircraft applications are for rotating

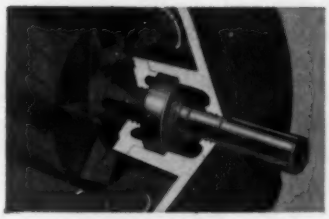
to HYDRAULIC ENGINEERS, Howell suggests

What to look for in the new re-rated motors

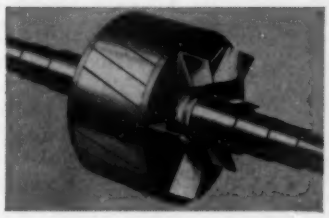
Want pump or compressor motors with all the space and weight-saving advantages of the NEMA re-rated frame size plus labyrinth-type ventilation to make them truly splash-proof? Below are some points for comparison and a few of the reasons why the new Howell "Series 100" motors are so outstanding!

VENTILATION . . . "Cool running" means long life in motors. The steel shell of a Howell motor and a new stator design with the largest air passages yet devised put ample ventilation where it's needed. Compare!





BEARINGS . . . They should be fully protected. Dirt can't enter Howell's double shielded bearings either from inside or outside the motor, because they are sealed in the end plate cavities by dust-tight inner caps. Compare!



COPPER-CLAD ROTORS . . . Howell motors have copper-clad rotors. This means better heat conductivity, stability at high temperatures and, as opposed to die-cast rotors, greater design flexibility to meet your special requirements. Compare!

Above: Construction details of the new Series 100 Splash-Proof Motor. Left: the Totally Enclosed Fan-Cooled Motor.

HOWELL MOTORS

radar antennas and positioning gun turrets. Constant-speed drives have been developed to drive a-c alternators at speeds varying not more than 1%. Recent units such as used on the B-36 have gained a reputation for reliability.

SHIMMY DAMPING AND STEERING

The shimmy damping and steering unit is either a vane or piston-type device, either geared or linked between the outer cylinder of the strut and the rotating piston tube. Torque-link steering, in which dual cylinders on a central cantilever link replace the upper scissors, is proving very popular because it eliminates numerous parts. Power steering systems are usually linked mechanically to a steering valve which is connected to the steerable portion, so that a follow-up arrangement is available. For increased reliability, the steering valve should be mounted integral with, or very close to the power steering units.

BRAKES

The original, piston-operated drum brake has been largely replaced by the expander tube or bladder brake. The trend in the past few years has been towards disc brakes, and this has been accentuated by the development of cerametallic linings with superior wear and heat resistant properties. Disc brakes are operated by one or more simple pistons with O-ring seals or by complete or partial annular pistons with V-ring or O-ring seals.

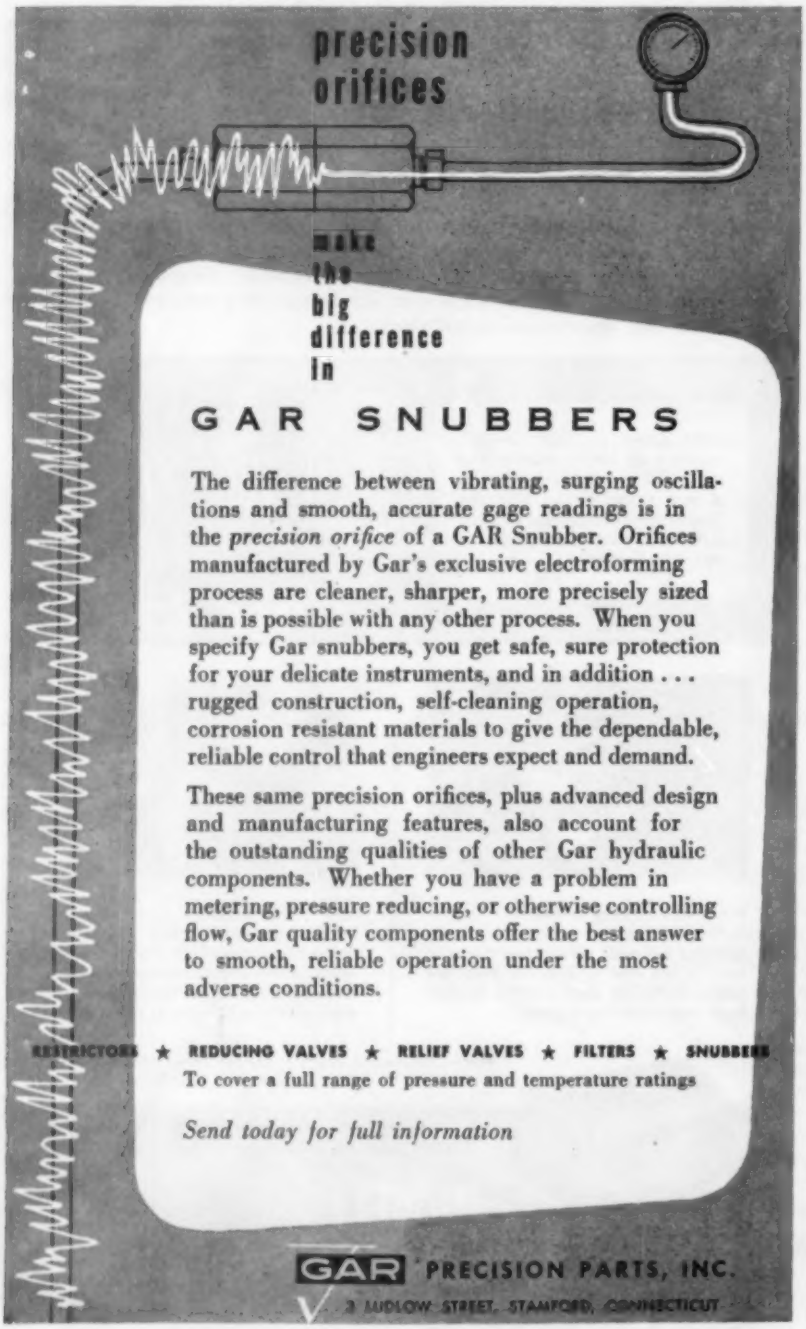
One hydraulic problem in brake design is temperatures close to the melting point of iron, induced by the tremendous energies the brakes must absorb within space and weight limits. Another problem is the development of a suitable adjuster. A brake with constant displacement regardless of temperature and wear is desirable. Most brakes have been of the mechanical friction type, but some very promising developments are being made in the hydraulic adjuster field.

ANTI-SKID MECHANICS

Anti-skid mechanisms are becoming more important in preventing skids, extending tire life, and providing shorter stopping distances with no pilot skill required. The electrical type operates a deceleration sensing unit, and the mechanical type utilizes a rotary fly wheel to directly operate a brake release valve.

FLIGHT CONTROL SYSTEM APPLICATIONS

At transonic and supersonic speeds the aerodynamic flow rules change so drastically that a balanced surface which is good for one range is entirely ineffective or gives reactions in the opposite direction for another range. Therefore hydraulic power is required to replace the previous method of manual control which used servo control surfaces to control the larger flight control surfaces. The major requirements of a surface control system are stable opera-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tion, quick response, adequate pilot "feel", extremely reliable operation, and ability to be integrated with the autopilot system. Great efforts are being made towards the electrically controlled system, but the probable compromise will probably be an electrically controlled system with manual follow-up. The first small pressure or movement of the pilot's control elements will operate switches that control the hydraulic system, but in the event of malfunction, a slight additional movement or pressure will actuate a mechanical control that operates the control valve.

AUTOPILOTS

The modern autopilot is largely an electrical and electronic device but uses hydraulic cylinders as the lightest and most convenient force elements available. One autopilot function performed with hydraulics is stability augmentation in which the pilot is made to feel that the airplane is stable even though this is not really so. Here the change in aerodynamic laws over the various flight conditions make it almost impossible to make a smooth flying airplane without auxiliary help.

FLAPS AND OTHER LIFT DEVICES

Flaps, leading edge slots, spoilers, dive brakes, and other lift and drag devices are readily adaptable to hydraulic control. The majority of these are simple two-position devices where the principle problem is synchronization. If they are slow-acting devices, some type of flow divider is usually provided. If they are rapid-acting devices, synchronization is usually obtained by pressure drop with balanced lines. Dive brakes must usually be capable of being positioned in a variety of locations and require a synchronized follow-up positioning system. Simple hydraulic cylinders are usually used for driving these mechanisms. ▼▼▼

The fall meeting of the National Fluid Power Association will be November 2-4, Edgewater Beach Hotel, Chicago.

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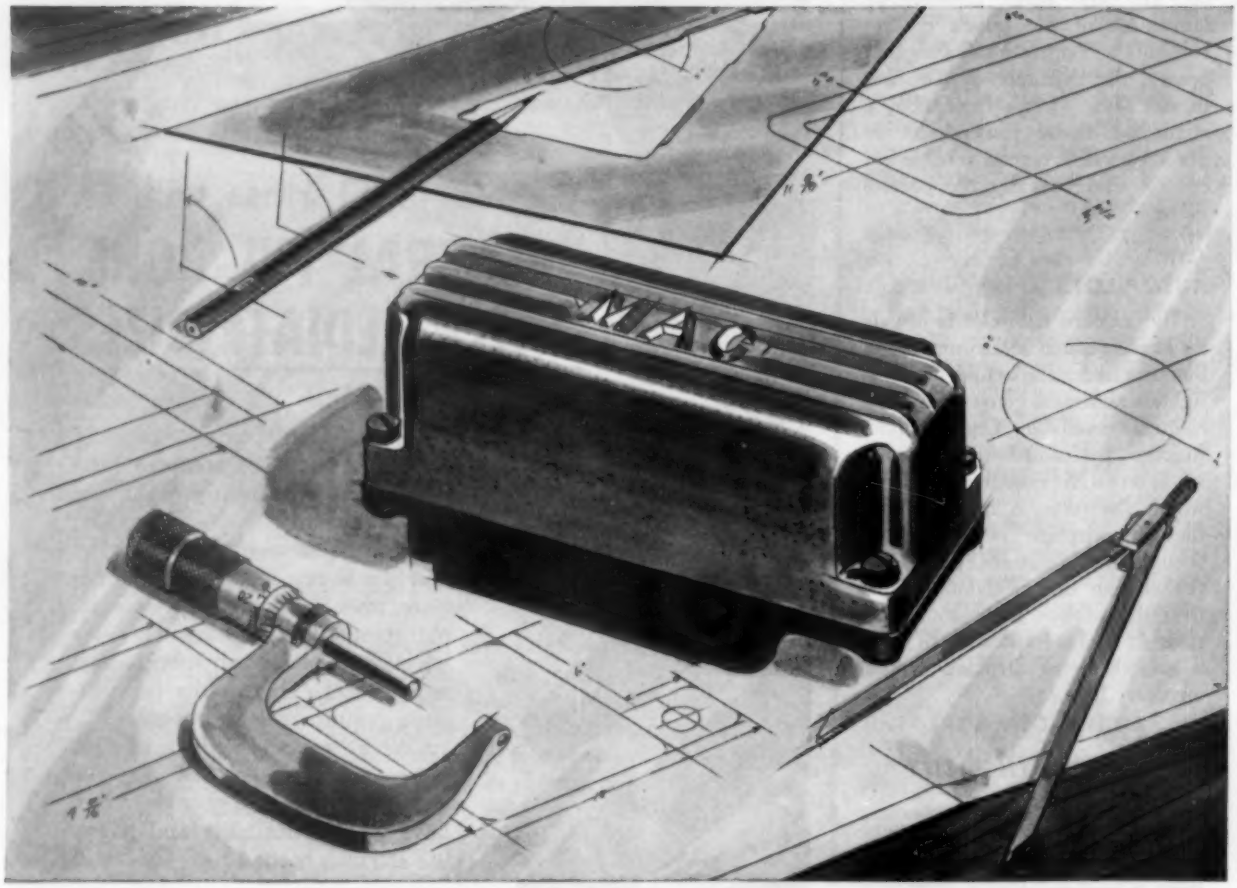

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Ideas from a Sales Engineer

Elmer F. Heiser

During Elmer Heiser's 18 years of selling air and hydraulic components, he has solved many problems and has left some unsolved. He is the author of the recently published book "*Air and Oil Cylinders in Industrial Applications*". Because we enjoy learning of Elmer's experiences and opinions, we've asked him to write these monthly columns. We hope you too are finding these columns amusing, interesting and informative.

AUTOMATION

QUITE a word! We hear and read about it almost everywhere. Strange how established means, motions, etc. when regrouped and named become glamorous. The word is glamorized and dramatized daily.

Maybe such popularizing treatment serves a purpose. It makes a lot of people conscious of activities outside their normal routine. Our local newspaper recently carried a column which painted quite a picture. Starting with some of the lesser wonders of modern industry, it worked into automation, then blossomed into a glowing dream picture of push-button factories of the near future. An outstanding industrial leader was quoted as stating that any industrial plant which didn't recognize automation and build toward the push-button age was doomed to failure.

Reality and popular conception may be far apart. Actually what is automation? Is it really anything more than the application and adaptation of established practices to keep pace with increased demands?

Doesn't it depend on mechanical, electrical, pneumatic and hydraulic combinations for results?

The other evening a local TV commentator chose "Automation" as the subject for a program and finished up with tongue clucking about the serious sociological problem, the impact on the working class, etc., etc.

It sounds a little like hog wash and right about here you can begin to suspect that this article dares to suggest that this automation proposition may be more than a little out of focus.

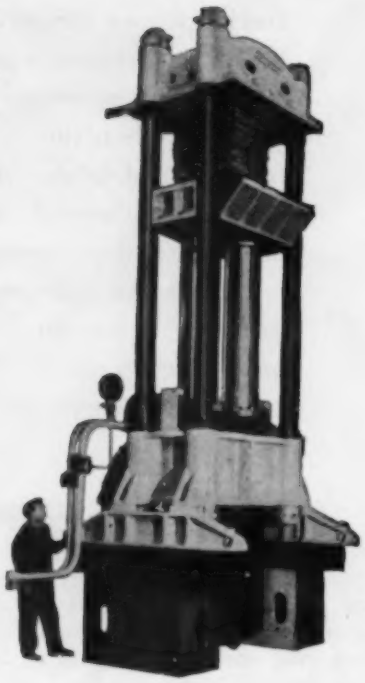
How's that for taking a bite at the hand that feeds? Where would air and hydraulic equipment manufacturers (and peddlers) be today if improved automatic equipment for industry had not made its upswing?

Notice the term "improved automatic equipment" instead of automation. That's a different story. No one can quarrel with advances which improve previous practice. If the improvement increases the demand for air and hydraulic equipment it can add some gravy to our bread and butter.

However, instead of doffing the chapeau and bowing gratefully in

the right angle on baling presses

— to rate its capacity to do the work for which it is designed: efficiently, economically and dependably. Considered from this angle, Fawcett Preston Baling Presses are giving excellent service and the number of repeat orders regularly placed for all types reflects their high reputation in industries at home and abroad.



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some direction or other when the word is mentioned, we choose to examine it for shortcomings. Newspaper, magazine and trade journal articles, together with contacts and observations in industry indicates a basic fallacy.

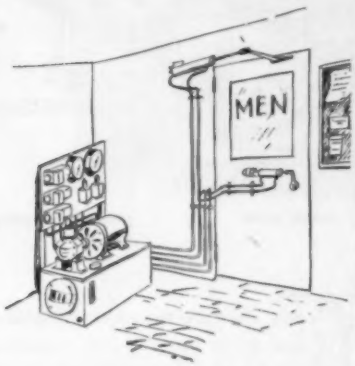
The fallacy or weakness is simply the cock-eyed notion conjured up by the word, due not to the word itself but to unrealistic publicity. We now find, for example, a department of automation in industry. There are engineers and directors of automation and courses are offered with automation as the subject. It would logically follow that if one starts as a student of automation, becomes accomplished and develops into an engineer or director of such, he should expect to work, plan, design or operate on some new and different level.

Therein lies the bone of contention. In reality the best answer to any production problem should come out the same whether an automation expert or an ordinary, alert and competent engineer tackles it. If the job is simple, and both the production runs and the tooling allowance are limited, there are not too many good approaches or answers to the problem. Facts are facts, whether by automation or by Joe Whosis. On the other hand, if production quantities are large and the tool investment is determined by final unit costs, the practical and logical method or answer should come out the same regardless of the name attached.

No argument should be raised on this point and doubtless many who are automation minded will agree. The difficulty which arises is that automation, glamorized, dramatized, eulogized, and somehow elevated, can provide the basis for complicating the approach and the answer to simple problems. We've seen installations which live up to a glamorous automation title; a couple of hundred feet of machinery with everything clicking though untouched by human hands. However, we've also seen automation which from any objective viewpoint was nothing more than a round about way

to incorporate a lot of electrical, pneumatic and hydraulic equipment into what should have been a fairly simple mechanical gadget. Had it been engineered and built simply, it would have been just another piece of mechanical equipment, but with all the trimmings it became automation.

A recent problem, containing a number of light, high speed movements, looked and sounded like a simple pneumatic application. The job came through the department of automation and as previous ex-

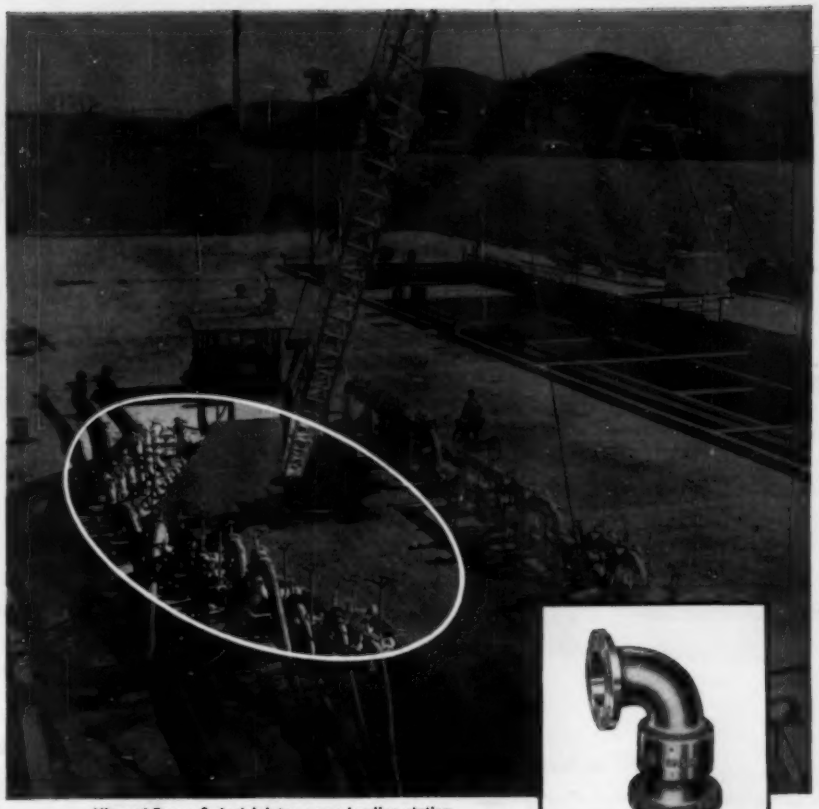


"Wait till you see inside."

perience had proven, "hydraulic better than air for automation", it had to be an involved hydraulic installation. Large lines, valves, an accumulator, shock and inertia factors, all crowded in to louse up the deal. Had the job been called "gadget" instead of automation it would have been quickly resolved on a logical basis.

It is a normal tendency to over design or over build. There's an old saying to the effect that complication is easy and natural but that simplification requires considerably more thought. Too much emphasis on a word, which by common use, or mis-use, connotes involved motions, mechanisms and procedures can encourage the natural human tendency to complicate instead of simplify.

Until automation is generally recognized and accepted merely as a quick way to say, "the simple, logical, most practical means to an end", it should be handled carefully. It might pay to be especially careful where misinterpretation causing needless complications runs up the operating and maintenance bill. ▼▼▼



View of Emsco Swivel Joints on one loading station.

Emsco 8" type LP Swivel Joint Style 2 with flanged ends for loading dock service.

EMSCO SWIVEL JOINTS SELECTED FOR NEW LOADING WHARF

We are proud to have supplied the Swivel Joints installed on this loading wharf making it one of America's newest and most modern loading facilities. Here are installed a score of Emsco 6" and 8" type LP Swivel Joints. Free turning and easy maintenance were prime factors in the selection of Emsco for this job. In the cross section note how the thrust load is absorbed through the ball bearings – how easily bearings can be adjusted. Note also how readily the packing can be replaced simply by separating the joint as one would a union. No return of joint to the factory for service. Emsco assures you a new kind of dependability in Swivel Joints.

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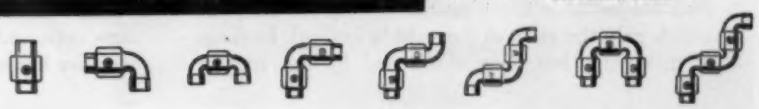


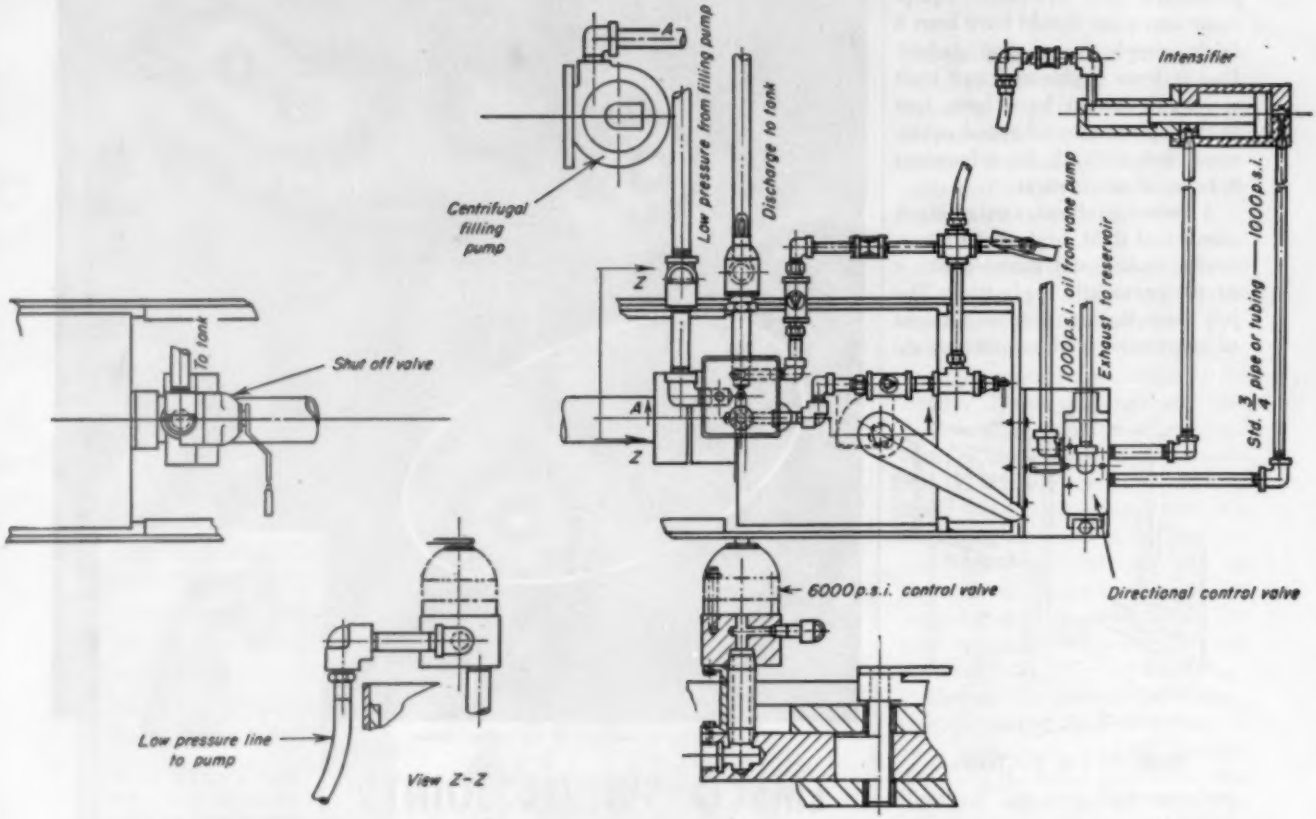


FIG. 1. PIPING LAYOUT for a single shot intensifier used to pressure test tubing.

Construction ideas for a

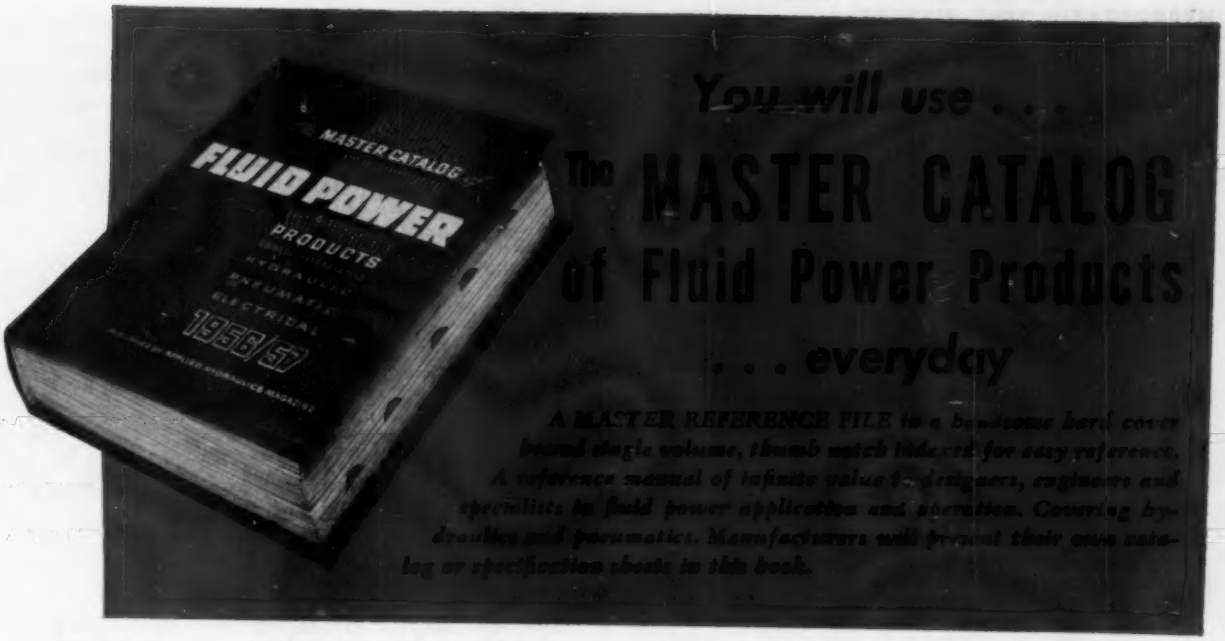
HYDROSTATIC TEST FIXTURE

Have you got a job coming up where tubes will have to be pressure tested? Although there may not be such a thing as a universal fixture, the hydraulics shown here may very readily be used on many test stands.

IF your test requirements call for hydrostatic pressures up to 6000 psi on a tube, the circuit shown in Figures 1 and 2 can be a guide for your design. This circuit is being used to test welded and seamless steel tubing.

A length of tubing is mounted between tow adapters, completely filled with soluble oil at 10 psi, and then subjected to 6000 psi. Design of the adapters which grip the ends of the tube is critical. Leakage at this point has been eliminated by the adapter design shown in Figure 3. The "U" type packing acts to seal and grip the tube. Adapters are changed in size to accommodate the range of 3, 3½ and 4 inch o.d. tube being checked. Other potential leakage points are at fittings and at the high pressure control valves. Use of rotary "shear-type" valves rated at 6000 psi minimizes leakage.

High pressure is produced by intensifying pressure delivered by a 1000 psi vane pump. This intensifier has an 8 inch bore and 10 inch stroke with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Engineering and Technical Data Section. This valuable section is edited with the practical requirements in mind of the designer, application and operating personnel in the major industries using fluid power circuits. A section on Basic Data will include specimen pneumatic, hydraulic and electrical diagrams; Fluid Power Circuits; pipe and tubing selection tables; charts of hydraulic fluid characteristics; graphic solution charts and fundamental formulae for selecting components and building circuits, etc.

There are separate sections covering major components of hydraulic and pneumatic circuits—pumps, valves, cylinders, packing and fluids, as well as control units and accessories.

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HYDROSTATIC TEST FIXTURE

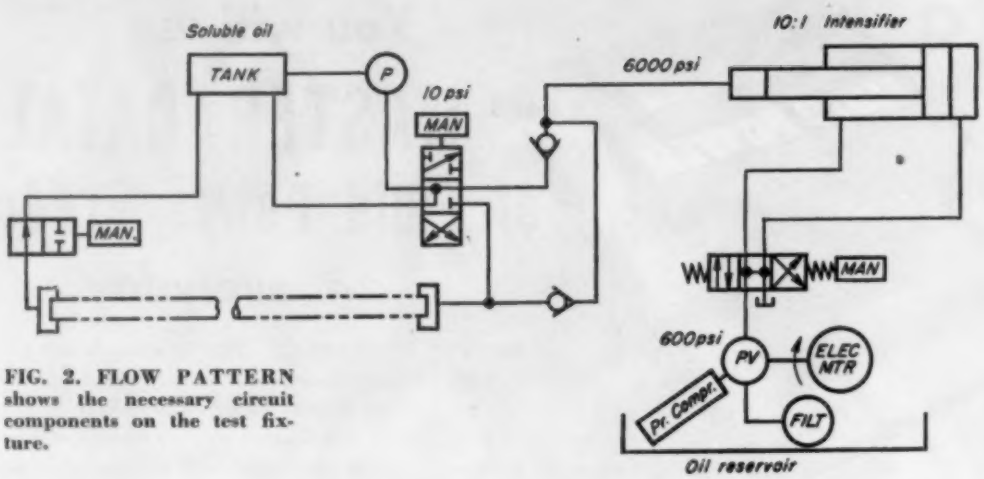

FIG. 2. FLOW PATTERN shows the necessary circuit components on the test fixture.

a 2½ inch piston rod. To provide a 6000 psi output, the pump is set to develop approximately 600 psi. Piston rings are used on the 8 inch diameter piston and "V" rings suitable for soluble oil are on the high pressure end of the piston rod.

The vane pump is a 12 gpm pressure compensated pump which shifts to near zero delivery when test pressure is reached. Intensifier control is by a manually operated 3 position, open center 4-way valve. This valve is spring centered.

Soluble oil delivered at 10 psi by a centrifugal pump fills the tube and the high pressure end of the intensifier. After filling, the delivery from the centrifugal pump is bypassed to tank. The intensifier is now operated to build up pressure in the tube.

The 600 psi control valve has three positions. In one position, low pressure soluble oil is directed to fill the tube. With the tube filled, the valve is

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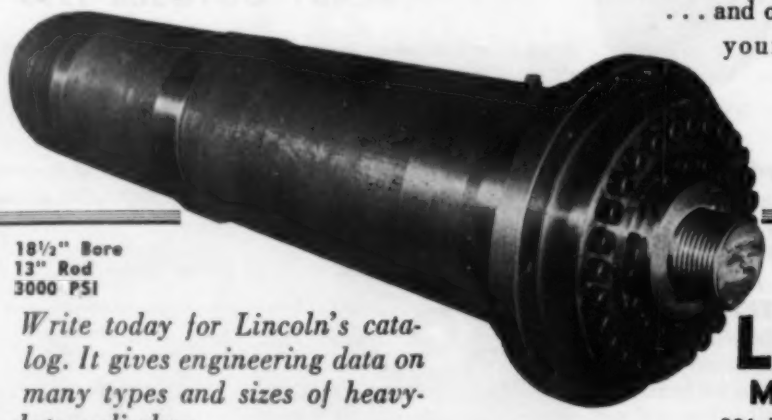

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shifted to bypass the low pressure soluble oil pump and holds high pressure on the tube. In the third position, soluble oil is directed to replenish the intensifier.

After the test, pressure is released by centering the 3-position open center valve in the hydraulic

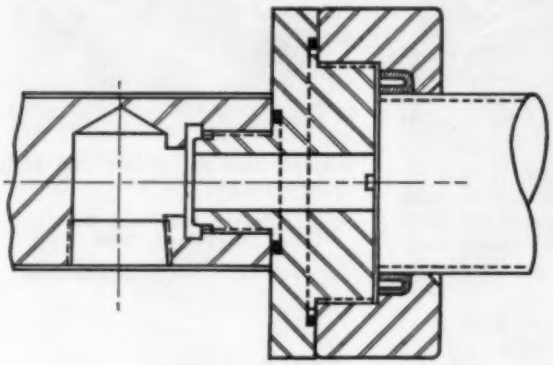

FIG. 3. ADAPTER designed to seal the tube ends.

oil circuit. This valve is spring centered to make it impossible to maintain pressure without the operator being present. The tube under test is emptied by opening the high pressure shutoff valve in the line from the tube end. ▼▼▼

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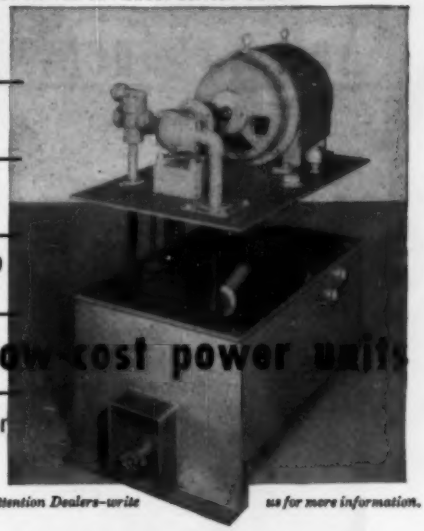

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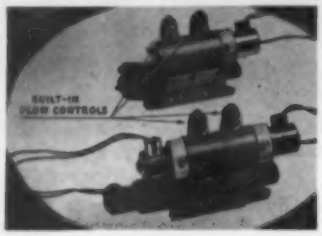

cations where continuous operation and compact piping are needed. Double and single-solenoid, pilot-operated valves are available. Both types have built-in flow controls.

Design: Valve has only two internal moving parts: a single balance spool-type stem that rides on O-rings, and the solenoid plunger with molded-in seats. The entire unit is completely sealed so that foreign matter does not hinder the internal operation.

Specifications: The solenoids are rated as continuous duty with a power consumption of 10 watts maximum. Valves can be supplied for most a-c and d-c voltages and are available in ¼, ⅜, ½, and ¾-inch sizes with pipe-tap size ports. Recommended pressures are from 20 to 150 psi for the double solenoid and 35 to 150 psi for the single solenoid.

Airmatic Valve, Inc.
Cleveland, Ohio

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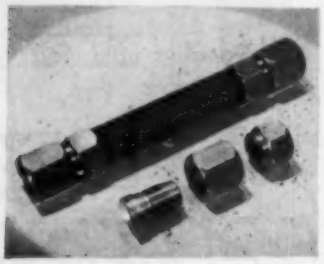
. . . and re-usable fittings

Design: Single fiber-braid (non-metallic) hose is for low-pressure service to 375 psi. Fiber braid is high-tenacity rayon for service with hydraulic fluids, water, and air. Skiving of the hose is not required when assembling with proper fittings. Fittings for ¼, ⅜, ½, and ⅝-inch ID hose are available with body types of 45-degree flare end, 45-



degree flare swivel nut, and male pipe thread.

Parker Appliance Co.
Cleveland, Ohio

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. . . for extreme temperature, pressure, speed

Designation: HH type

Features: Seals are effective in a minimum space both radial and axial and feature a variable pressure balance and a new method of incorporating synthetic rubber, silicone, Teflon, and Kel-F. Model HH-A is for use when fluid pressure is applied externally. Model HH-B is for use when fluid pressure is applied internally. The seals employ a wave spring to maintain

axial pressure loading on the synthetic resilient internal parts and to the rotating seal joint, whether or not liquid or gas pressures exist at the seal. When liquid or gas pressures are to be sealed, the internal seal parts are designed to utilize only that portion of the pressure which, when added to the spring load, will provide the total axial force required to maintain an effective seal without overloading the seal joint. Seals are available for shafts from ¼ to 4 inches.

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Chicago, Illinois

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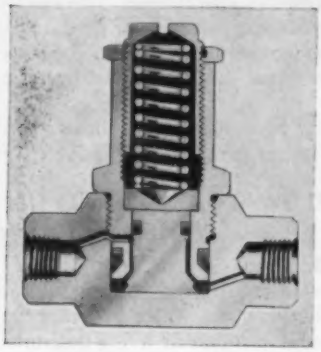
GAGE PROTECTOR

. . . adjustable cartridge-type

Design: Protector has a spool-like plunger within a removable cartridge. Connections are in-line, and spring-pressure adjustments, or changes of cartridge are made without removing from the line. Unit is designed for use in hydraulic systems with working pressures up to 10,000 psi. Springs are available for standard maximum gage readings from 15 to 5000 psi. When line pressure reaches spring setting, plunger shuts off gage instantly,



protecting it from damage. Opens immediately when pressure returns to normal.

Construction: Entire mechanism is encased in a cartridge which may be removed for cleaning or repair, or to change to one having a different maximum gage reading. Standard body materials are aluminum and stainless steel, with line port ¼ inch FPT.

Republic Manufacturing Co.
Cleveland, Ohio

Circle 188 on Reader Service Card

PRELOAD INDICATING DEVICE

. . . replaces torque wrench

Designation: PLI washer

Design: Device consists of two concentric steel rings, and is installed on the bolt. Inner ring is slightly wider than outer ring and is compressed by the nut until bottoming against the outer ring.

Features: Provides an accurate, fool-proof means for tightening bolts to predetermined preloads as high as 80% of bolt yield strength. This high preload which permits utilizing more of the inherent strength of the fastener is almost twice the average preload ordinarily induced with torque wrenches. Since the higher the initial preload,

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New Products continued

the greater the life and design strength of bolts in fatigue, the device will permit use of fewer bolts or smaller bolts for a given load in

many applications. The unit is especially applicable to aircraft where it permits savings in weight. Flight and laboratory tests have shown that the washer assembly is accurate to within plus or minus 10% of the predetermined preload. Washers are available for a wide variety of bolt types ranging in ultimate tensile strengths from 80,000 to 240,000 psi.

Standard Pressed Steel Co.
Jenkintown, Pennsylvania

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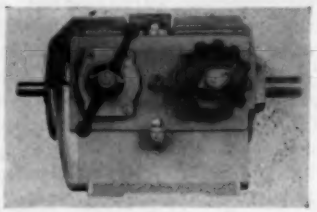
HYDRAULIC TRANSMISSION . . . variable speed to 1500 rpm

Design: Unit consists of an oil pump and motor incorporated in an air-cooled housing which also acts as the six-quart oil reservoir. All working parts are self-lubricated from the reservoir which requires attention only at infrequent intervals. Low internal operating pressures of 300 to 350 psi and sturdy ball-bearing construction ensure long life. Transmission may be directly coupled to the electric motor supplying the constant speed input power or belt driven from a side or top mounted motor.

Features: Overload protection is provided by safety valves. Output speed may be evenly regulated by controlling pump displacement, or motor displacement or both. Output speed at constant torque may be regulated by stroking the pump;



constant horsepower is achieved by stroking the motor. Changes of speed and direction of rotation may be accomplished during operation or while the unit is not operating.

Geroter May Corp.
Baltimore, Maryland

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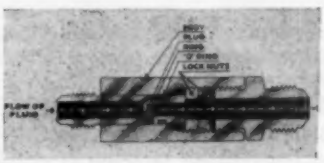
FLOW CONTROL VALVE . . . with fixed orifice

Design: Control of the flow is regulated by the surface finish of the plug seat where hydraulic fluid seeps through at a pre-determined



rate, controlled by the degree of grinding during manufacture. There are no moving parts.

Features: Unit is designed to control flow required at any pressure up to 5000 psi. Eliminates clogging and need for filters which may be a maintenance problem with metering devices especially on jet aircraft. Valve has an over-all diameter of ⅜ inches.

Magnetic Seal Corp.
Georgiaville, R. I.

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AIR LUBRICATOR . . . for tight quarters

Designation: Type S

Design: Unit consists of a head-bowl assembly equipped with a separable, venturi block. Block can be unscrewed by hand and roughed into an intricate compartment in the same manner as any common pipe fitting and within the same clearances. Head-bowl is then screwed into the venturi block. Bronze lubricator wick projects upward from the bowl into the chamber of the venturi block. The

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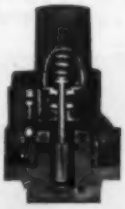

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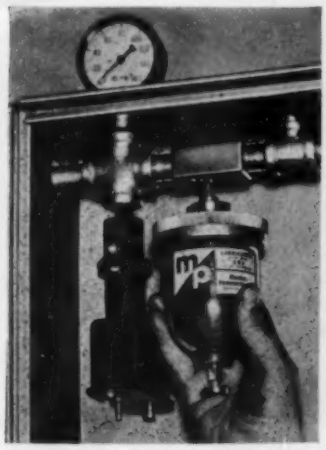
amount of projection governs the oil-feed rate and is pre-set, according to the air-lubrication needs of each application. One head-bowl fits all sizes of venturi blocks and may be replaced without tools or breaking of pipe connections.

Features: Lubricator meets JIC requirements of locking-enclosure mounting of pneumatic devices. It fits snugly and easily into machine compartments and other restricted locations which will not accommo-



date other types of lubricators. Separability of venturi blocks and head-bowl assembly helps to reduce installation hazard and damage. Head-bowl unit may be left in stock until plumbing rough-in and construction work are completed. Lubricators are available from ¼ to ¾ inches rated at 20 to 120 cfm free air delivery.

Master Pneumatic, Inc.
Detroit, Michigan

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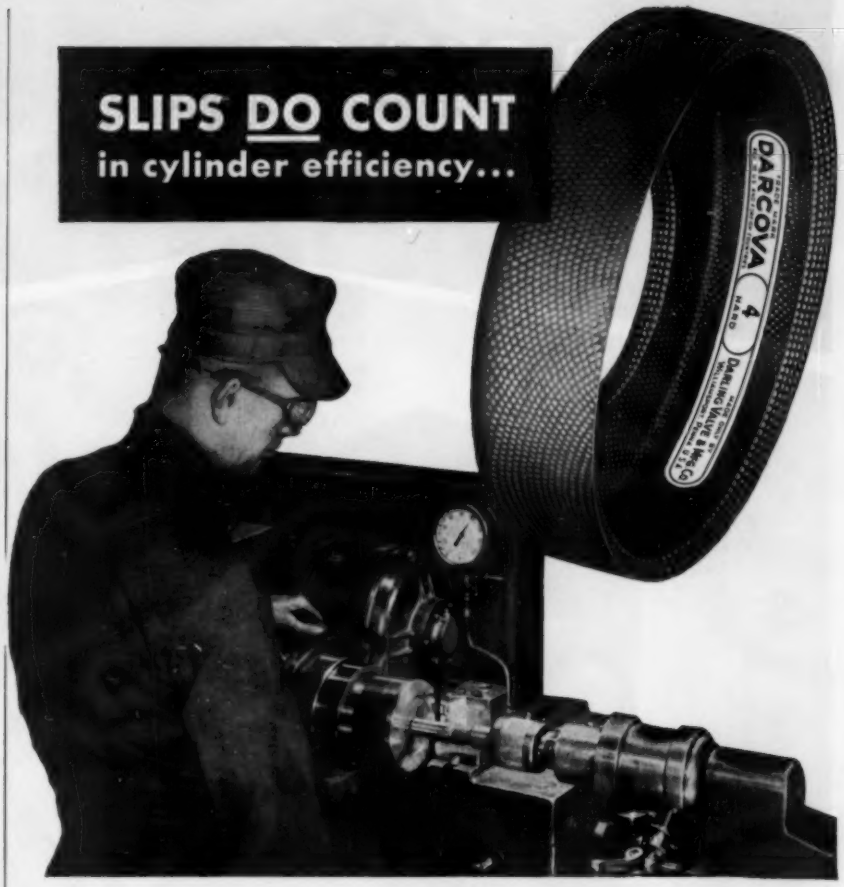
HYDRAULIC DRILLING UNIT . . . compensates for temperature changes

Designation: Model 500

Features: Variable delivery hydraulic pump is an integral part of the spindle and quill. Hydraulic feeding thrust is applied directly behind the spindle eliminating deflection and assuring smoothness of feed on heavy operations. A locked-circuit feed eliminates constant adjusting required when the temperature of hydraulic oil changes. This maintains a constant pre-set, feed cycle. Tool is completely automatic and all controls, although built in for compactness, are accessible. An emergency, cycle-return button is provided on the front of the unit and rapid traverse is controlled by limit switches on the side. Unit has



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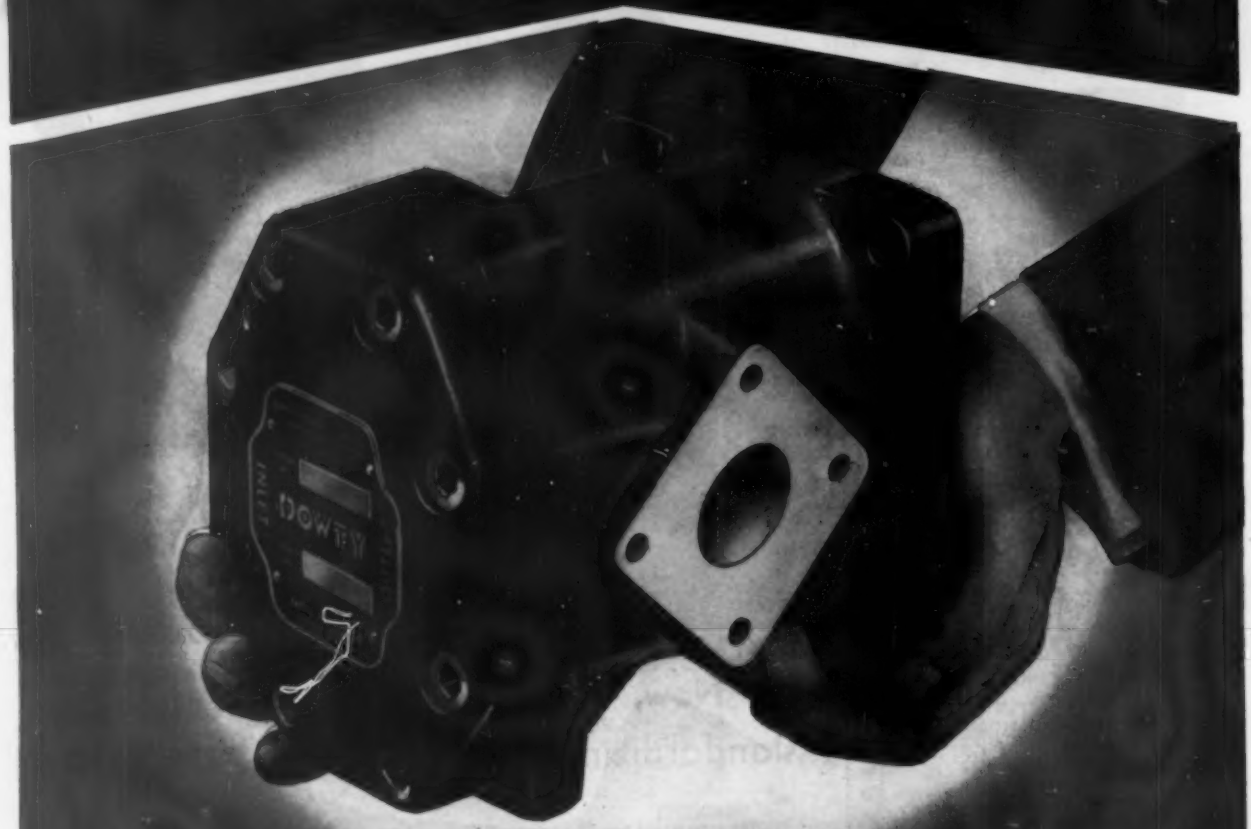

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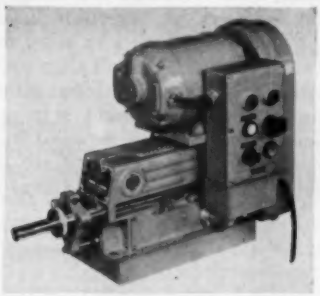
reserve thrust as much as five times requirement at all spindle speeds, infinitely variable rates of traverse, positive depth control, thrust con-



trol, and infinitely variable feed rate. Maximum stroke is 5 inches, and on finishing a drilled hole there is no forward surge of the drill. This eliminates costly burring and much tool breakage.

Drillmation Co.
Hazel Park, Michigan

Circle 193 on Reader Service Card

LIMIT SWITCH
...low force, heavy duty

Designation: 1ML10, 101ML10

Features: The limit switch can be operated with only 2½ ounces of force and is expecially applicable to

counting operations or similar applications which require heavy duty switches with light operating force.

Application: The actuating lever is a 5-inch aluminum rod, ⅛-inch in diameter, which can be bent or cut off to fit a particular application. Operation can be either clockwise or counter-clockwise. A full 60-degree overtravel permits use in ap-

Circle 19 on Reader Service Card

What he needs is a

STAFFA HYDRAULIC RAM!

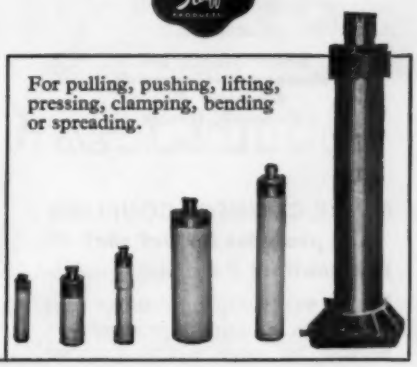
Staffa Rams are available in four standard ranges: high and low pressure solid, high pressure hollow and tubby rams. Loads from 1 to 150 tons. Pressures up to 5,000 p.s.i., strokes up to 36". Higher pressure and larger stroke rams are made specially.

For rams, pumps and all other hydraulic equipment write to Chamberlain Industries Ltd., Staffa Works, Staffa Road, Leyton, London, E.10.

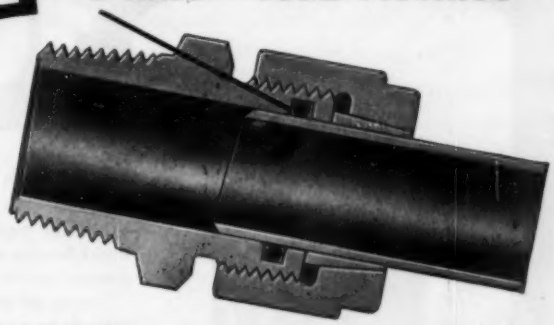
CHAMBERLAIN INDUSTRIES LTD.

Staffa Works, Staffa Road,
Leyton, London, E.10, England.
Telephone: LEYtonstone 3678.

For pulling, pushing, lifting, pressing, clamping, bending or spreading.



LENZ "O-RING" TUBE FITTINGS



ELIMINATES FLARING, THREADING, WELDING, SOLDERING

A HACKSAW AND FILE IS ALL YOU NEED

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. Nut fits loosely on the tube for ease of assembly. The higher the pressure the tighter the grip. LENZ FITTINGS are ideal for quick, simple, easy to assemble, leak-proof connection — for steel or copper tubing — on air and hydraulic systems.

DO YOU KNOW ABOUT LENZ REDUCER COUPLINGS?

Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

LENZ COMPANY

Box 1044-A • DAYTON 1, OHIO • ORegon 9364

New Products continued

plications where operating motions cannot be accurately controlled.

Design: A rugged aluminum enclosure protects the precision switching unit from physical damage, seals the switching chamber against the entry of foreign matter, provides a means of mounting, and permits conduit-type wiring. The unit is easily wired or replaced without removing the enclosure from its mounting. Model 1ML10 is single-pole, double-throw; model 101ML10 is two-circuit break. Both are designed for 10 amperes.

Micro Switch Div.
Minneapolis-Honeywell Regulator Co.
Freeport, Illinois

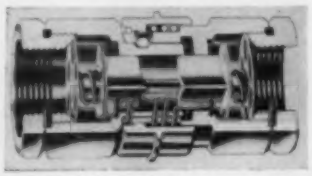
Circle 194 on Reader Service Card

QUICK-CONNECT COUPLING

. . . provides instant shut-off

Designation: E coupling

Features: Coupling assures full flow with minimum pressure loss because its large inside diameter and recessed valve washer combine to give clean flow lines. Recessed valve washers allow a positive metal to metal stop when valve is closed,



controlling compression and displacement of the valve washers. Extra-strong barrel springs hold the valves closed when disconnected.

Specifications: Coupling is available without valves if desired. It is furnished in alloy steel, brass, aluminum, and stainless steel. Sizes range from ⅛ through 3 inches ID. Sizes to 10 inches are available on order.

Snap-Tite, Inc.
Union City, Pa.

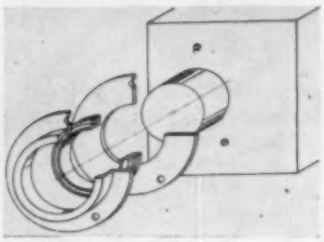
Circle 195 on Reader Service Card

ADAPTERS

. . . for scraper rings

Designation: Hydro-wype

Design: The adapter permits installing scraper rings on cylinders to increase the life of packings and bearings. The assembly consists of a front retainer plate and a back plate. The scraper ring is placed between these two rings. The Gadgets, Inc. adapters are precision made with built-in clearance to allow the scraper ring to float, and align itself with the shaft permitting rotation of the scraper ring during reciprocation. The adapters are supplied with ½-inch mounting rim and are installed by drilling clearance holes in



the top and bottom adapter plates, and a similar set of holes in the end of the cylinder bearing or rod guide.

Specifications: The adapters are

108 Standard Models

Honan-Crane Multi-Cartridge Filter

Why 108 models of the same basic filter? *Because each oil filter application creates individual problems.*

Scores of variable factors are involved: type of oil, additives, oil viscosity and temperature, flow rate, capacity, space available, nature and degree of contamination, type of heating required, and many more. *All* of these factors must be considered in selecting the proper filtration unit.

Honan-Crane Multi-Cartridge Filters are available in 108 models, 10 sizes, and with six different types of interchangeable cartridges, each designed to do a special filtering job.

Thus, no matter how unusual or difficult the application, you get a filter exactly suited to your requirements . . . and readily adaptable to *changing* requirements.

The same wide choice of models is also offered in Honan-Crane Bulk Refill and Full Flow type Oil Filters. Custom filtration performance is *standard* with Honan-Crane.

Write for three 8-page Equipment Bulletins:
No. 101—Full Flow Filters
No. 201—Multi-Cartridge Filters
No. 301—Bulk Refill Filters

HH of Indiana
HOUDAILLE-HERSHEY OF INDIANA, INC.
FILTRATION DIVISION

A SUBSIDIARY OF
HOUDAILLE-HERSHEY CORPORATION
102 Wabash Ave., Lebanon, Indiana

Circle 54 on Reader Service Card

made in standard sizes for use with scraper rings with ½-inch ID up to and including 30-inch diameter. Special adapters can also be tailored to fit individual requirements.

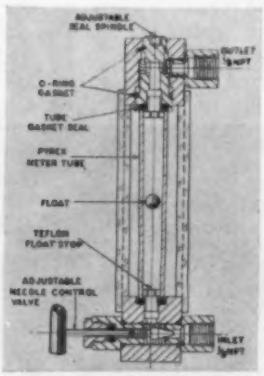
Associated Technical Sales Co.
Dayton, Ohio

Circle 196 on Reader Service Card

FLOW METER
...for small flows of liquids or gases

Designation: Sho-Rate "50"

Features: Flow meter is built for operation at temperatures to 250 F with a pressure rating of 200 psi. Units can be furnished for 400 psi service at 100 F. Rugged side-plate construction supports standard purge tubing runs and resists normal line strain. Scale length of the flow meter has been extended to 2½ inches to increase readability. Two separate scales are etched in



different colors on the metering tube against a yellow background.

Design: Tubes are easily removed for cleaning or replacement without disassembling the meter. End fittings are rotatable at 90-degree intervals to facilitate piping and mounting. Meter has valve seats and trim of the same material as the body: anodized aluminum, chromium plated brass, or stainless steel. Needle valve is available as an accessory.

Brooks Rotameter Co.
Lansdale, Pennsylvania

Circle 197 on Reader Service Card

CHARGING VALVE
. . . for accumulators

Applications: Valve was specifically designed for the Army, Navy, and Air Force and is interchangeable with any previous AN valve being used to change hydraulic and pneumatic systems with gas. Designed for a 5000-psi working pressure and 20,000-psi burst pressure,

Fast change-overs are easy on the new

NP Power Drive Cylinder

This cylinder has *all* the *most wanted* design features . . . provides exceptional adaptability, quick assembly and disassembly. You can make *many* fast change-overs using the simplest tools. Cushioning is easily adjusted; packing and internal parts can be changed; operation modifications can be made quickly on the *basic* cylinder.

No other cylinder offers so many vital features: compact, streamlined design; lightweight aluminum alloy and steel construction with *no* sacrifice of strength; sealed-in lubrication which eliminates need for external line lubricators. Operates with air, water or oil without interchanging or adding parts.

RATINGS: air — 200 psi; water or oil — 500 psi; Bore diameters: 1½", 2¼", 3", 4". Mountings: foot, flange, pivot, clevis, trunnion

NATIONAL PNEUMATIC CO., INC. AND **HOLTZER-CABOT** DIVISIONS

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NATIONAL PNEUMATIC CO., INC.
125 Amory Street, Boston 19, Massachusetts

Gentlemen: Please send me design information on the NP Power Drive Cylinder . . Include information on NP Power Check feed control — NP Power Trol valves —

Name.....

Title.....

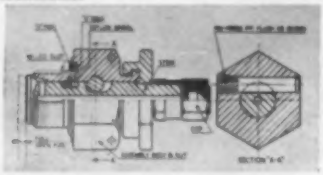
Company.....

Street.....

City..... *Zone*. ....*State*.....

New Products continued

the valve is being used in landing gear, accumulators, and similar applications.



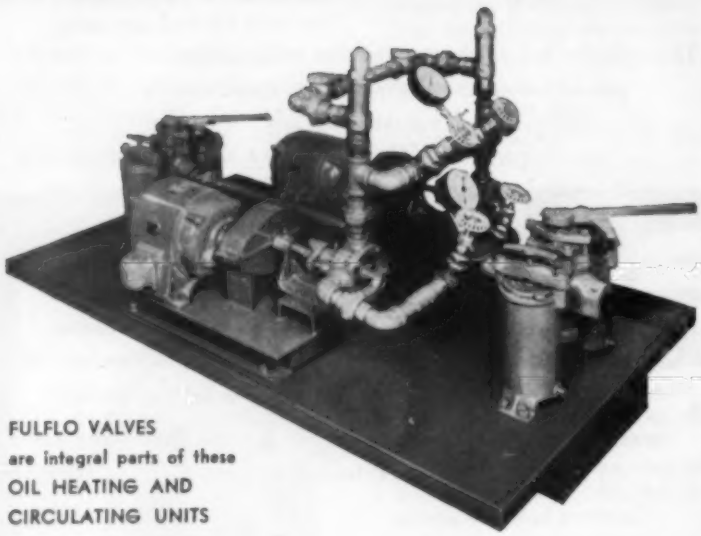
Design: A prime safety factor of the valve is the pin built into the locking head. This prevents the stem from dropping into the body of the gas cylinder and eliminates resulting equipment damage. An adjustable stem that works as an ice crusher eliminates ice formation around the gas inlet ports caused by the accelerated and expanding charging gas. The stem permits the complete and safe charging of the cylinder. Personnel injuries caused by a flying assembly, are eliminated through the use of milled slots in the male threads of the body. The new design allows gas to escape rapidly when bleeding the system and warns the operator that the system is still pre-charged. Design eliminates the conventional valve core and is leakproof and dependable.

Superior Hydraulics Division, Superior Pipe Specialties Co. Cleveland, Ohio

Circle 198 on Reader Service Card

"FULFLO" OIL PRESSURE RELIEF VALVES

INSURE CONSTANT, UNIFORM, PRESSURE



FULFLO VALVES
are integral parts of these
OIL HEATING AND
CIRCULATING UNITS

engineered and built by
HAUCK MFG. CO., Brooklyn, N. Y.
Manufacturers of Oil and Gas Burners and Equipment

These valves are installed in a jiffy . . . and stay put! Desired pressure is determined by 5 springs. . . . NO MAINTENANCE REQUIRED. From 0# to 500#. Standard and flange models, pipe sizes: ¼" to 2".

Write on your letterhead for personal copy of

FULFLO MECHANICAL DATA BOOK

Please specify if for Pumps or Valves, or both.

FULFLO THE FULFLO SPECIALTIES CO. Inc.
PUMP AND VALVE MANUFACTURERS
BLANCHESTER, OHIO

SOLENOID HEADS

. . . provide safety features

Features: Solenoid heads have been developed for 3 and 4-way valves to meet new JIS electrical recommendation that air cylinder control valves should be electrically inoperative if a maintenance man should remove a solenoid cover and fail to replace it. Solenoid covers are die cast of zinc alloy and so gasketed that the valve becomes splashproof and dust tight. Each

cover is chained to the valve so it cannot be mislaid. It is held in place by four captive screws which do not fall out of their holes in the cover when loosened. At the end of each cover is a manual operating button which can be operated with a small screwdriver or pencil to manually operate the valve without removing the cover. Valves with these solenoid heads are available in all standard sizes from ⅜ to 1¼ inch. Both single-solenoid and double-solenoid (momentary contact) models are available. Solenoid heads are also available separately.

Hannifin Corp.
Des Plaines, Ill.

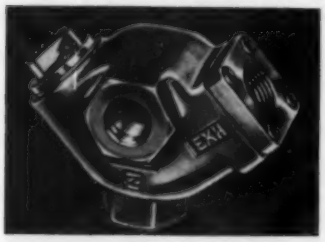
Circle 199 on Reader Service Card

AIR EXHAUST VALVE

. . . opens automatically

Features: Oversize exhaust opens

automatically on reversal of the main operating valve permitting almost instantaneous discharge of ex-



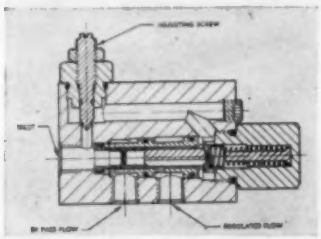
haust at the cylinder. Unit is available in four models with pipe sizes of ⅜, ½, ¾, and 1 inch.

Ross Operating Valve Co.
Detroit, Michigan

Circle 200 on Reader Service Card

FLOW REGULATOR
. . . combines bypass and restrictor

Features: Regulator is designed to maintain a constant, regulated flow when pump output varies or is greater than required for part or all of the system. In addition to the constant adjustable regulated flow, the design provides additional flow from the bypass port that can be used for operating other parts of the hydraulic system. Regulators can be connected in series to provide additional regulated circuits from one pump or power source.



Over-speed of the controlled unit when pressure at the bypass port is high is prevented by the restrictive design feature. Flow can be regulated from ½ to 7½ gpm and will not vary more than ±5% as long as fluid specifications are not materially changed. Flow is only slightly affected by pressure, temperature, or viscosity.

Fluid Controls, Inc.
Mentor, Ohio

Circle 201 on Reader Service Card

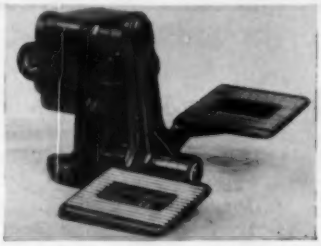
AIR VALVE
. . . for foot operation

Designation: Model 2800

Design: The four-way valve contains a pressure-balanced, self-aligning valve seat and a shear seal in constant contact with a rotor containing flow passages. Actuation of the valve shears the flow and the square external corner of the shear seal face wipes the rotor clean. The valve has three possible settings: spring return to either extreme, to the center, or without spring return.

Installation: Any port may be used as the pressure port. For convenient piping, the valve body can be rotated in 90-degree increments. A sturdy mounting bracket is an integral part of the valve.

Construction: Non-corrosive materials are used in the valve since corrosion is one of the major causes



of failure in foot-operated valves. Shear seals are brass, and rotor is bronze. Shaft and detent ball are

NATURAL SYNTHETIC SILICONE
RUBBER PARTS AND COMPONENTS

Custom-Made BY GOSHEN
TO MEET HYDRAULICS INDUSTRY NEEDS!

Producing custom-designed parts, of carefully-compounded materials, is a Goshen specialty. Parts are not stocked, but are fabricated exclusively on order to meet your strictest specifications as to compound, service-life and operating satisfaction.

Your inquiry regarding any rubber parts problem is invited.

make GOSHEN your HEADQUARTERS for

CUPS · BELLOWS · RUBBER-TO-METAL
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CONTAINERS · PACKINGS · WASHERS
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Goshen Rubber Co. INC. Goshen, Ind.
CUSTOM DEVELOPMENT AND FABRICATION SINCE 1916

GET GOING WITH GOSHEN

1595 S. TENTH ST.

Circle 47 on Reader Service Card

New Products continued

stainless steel. Valve body and housing are aluminum. Valves are available in ¼ and ⅜-inch port sizes.

Barksdale Valves
Los Angeles, Calif.

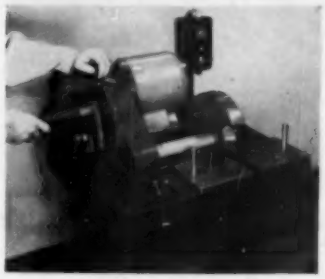
Circle 202 on Reader Service Card

HOSE TOOL
. . . prepares wire braid hose

Designation: Model 1149-12

Application: Power tool is for cutting and preparing either cotton or rubber covered hose for fittings. The machine handles sizes ranging from ¼ through 2 inches ID of high-pressure, rubber-covered, double wire-braid hose; low pressure, rubber-covered hose; and cotton-covered, single wire-braid hose.

Design: 10-inch cutting wheel is belt driven and made of hi-speed steel, hardened and ground for smooth, dust-free, long-lasting service. Skiving wheel mounted on the motor shaft has a wire brush which



removes rubber to a predetermined length without injury to wire braid.

Parker Appliance Co.
Cleveland, Ohio

Circle 203 on Reader Service Card

JOY
SURGEPRUF
HYDRAULIC HOSE AND RE-USABLE COUPLINGS

3 Big Advantages for Your Hydraulic Assemblies

PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE

Insure longer wear in your hydraulic hose assemblies —and at the same time, save assembly time by avoiding old-fashioned skiving. Joy Surgepruf re-usable couplings make *both* advantages possible. Their exclusive "double-wedge" grip lets you use tough, abrasion-resistant, rubber-covered hose instead of the braided type—without any need for skiving the hose at the connection.

NO SPECIAL ASSEMBLY TOOLS REQUIRED

You need no mandrels or other special tools to make up Surgepruf assemblies. No extra expense or special technique is involved.

CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE

Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—*another* exclusive feature.

Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively.

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.

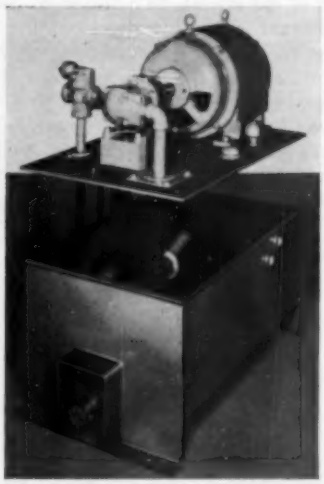
Get complete data on Surgepruf:
WRITE FOR BULLETIN H-100b
Consult a Joy Engineer

JOY
HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY

W&D H5514

HYDRAULIC POWER UNITS
. . . from ¾ to 20 hp.

Features: Power units are made with stock hydraulic reservoirs in capacities from 20 to 100 gallons. In



conforming to JIC Standards, electric motors, pumps, and necessary valves are mounted on the tanks which are already equipped with the basic accessories of fittings, pipes, filler cap, etc. The rigid, one-piece units are very compact.

The Rosaen Co.
St. Clair Shores, Mich.

Circle 204 on Reader Service Card

OIL CYLINDER
. . . has stroke control

Designation: Model 248-80

Features: Stroke control allows positive setting of the piston stroke, and permits easy selection of any stroke setting. Unit is especially applicable to graders, plows, com-

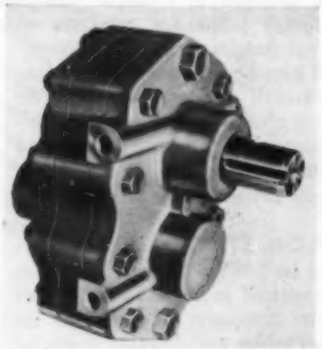
bines, and many other types of heavy or light tillage equipment.

Dukes Company, Inc.
Schiller Park, Illinois

Circle 205 on Reader Service Card

GEAR PUMPS & MOTORS
. . . develop 7 to 27 hp

Construction: Pumps and motors are made with precision-cut steel gears, ground and polished shafts,



needle bearing, and improved seal.

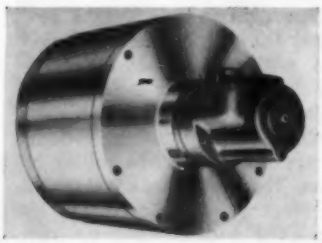
Specifications: Motors develop up to 27 hp at 800 rpm with pressure of 1000 psi. Pumps are rated for pressures to 1200 psi and 1500 rpm.

Hydra-Flex, Inc.
Claremont, Minn.

Circle 206 on Reader Service Card

ROTATING HYDRAULIC CYLINDER
. . . for machine tools

Features: Hydraulic cylinder provides greater force in a smaller area than is possible with an air cylinder.



Built in various bore sizes, it is rated for use with pressures up to 750 psi and at speeds up to 3000 rpm. The cylinder is alloy iron and is balanced for high speed use.

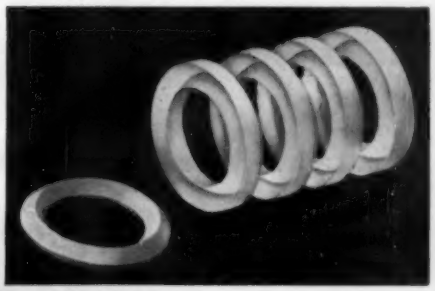
S-P Manufacturing Corp.
Cleveland, Ohio

Circle 207 on Reader Service Card

in the plant...
or in the air
it's Chemiseal Hydraulic Packing

Made of duPont TEFLON—Chemiseal hydraulic packings have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents. Unsurpassed in anti-friction properties, tough, resilient, non-flammable, long wearing, chemically impervious. Service temperature range minus 110°F to plus 500°F.

Chemiseal V-Type Packing



Chemiseal Back-Up Rings

Chemiseal V-type packings seal with low gland pressure and operating torque. Ideal for either manual or automatically operated valves. Square-end TEFLON adaptors are available if required. Catalog TP-1053.

Chemiseal back-up rings greatly extend "O" ring life and prevent extrusion. Available in solid, split and spiral types in all commercial and AN Sizes.

made of duPont TEFLON

UNITED STATES GASKET COMPANY
CAMDEN 1, NEW JERSEY

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FABRICATORS OF FLUOROCARBONS & OTHER PLASTICS
Representatives in principal cities throughout the world

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Circle 25 on Reader Service Card

AIR

This Inexpensive, Lightweight Pneumatic Power Source Can Simplify YOUR Hydro-Pneumatic Automation or Processing Problem

MODEL 130R1401
WEIGHT 79 Lbs.
ENVELOPE 14 x 14 x 24 In.

Cornelius

PORTABLE COMPRESSOR
Rating 3000 Pounds
Per Square Inch
2 CFM Free Air

Cornelius Portable Air Compressors provide dry, clean air for every high pressure low volume requirement. Four models available. Electric or gasoline powered. Complete and ready to operate.

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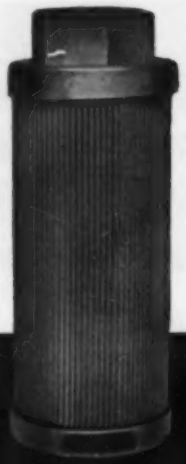
POWER

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH



The New
CAPITAL HYDRAULIC OIL FILTER
WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery

EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST

SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

Useful Literature / continued

FLEXIBLE METAL HOSE . . . and expansion joints are covered in Catalog 149 distributed by Flexonics Corp. Included in the catalog is a corrugated metal hose of stainless steel, designed for working pressures up to 3100 psi and temperatures to 1600 F. It is especially suitable for use wherever conditions require resistance to corrosion and/or vibration, pressure tightness for liquids or gases, relatively high burst and crush strength, extreme flexibility, high or low temperature capacity, and the ability to withstand bending in multiple planes. Expansion joints for pressures to 300 psi consist of a flexible corrugated member fitted with precision-mated neck and control rings. The catalog gives complete specifications on dimensions, pressure ratings, and construction.

Circle 233 on Reader Service Card

TEFLON STOCK . . . manufactured by United States Gasket Co. is presented in Bulletin 300 issued by the company. The bulletin includes tables and descriptive matter on the chemical, electrical, thermal, and mechanical properties of Teflon. Standard dimensions, weights, and tolerances are tabulated, covering sheets, tape, molded cylinders and bars, beading, and extruded shapes. Special molding techniques and bonding of Teflon to other products are described.

Circle 234 on Reader Service Card

FLUOROCARBON TUBING . . . Resistoflex Corp. has released Bulletin FTL-1 on their tubing manufactured from woven glass impregnated with Teflon resin. The bulletin describes the physical and chemical properties of the tubing which ranges in size from 1 to 4 inches ID. Recommended maximum working pressure for the 1-inch standard tubing is 300 psi. A detailed description of flanging and coupling installations is included and applications for the tubing are shown. The tubing has a wide working temperature range from —100 F to 500 F with no effect on inertness to corrosion.

Circle 235 on Reader Service Card

AUTOMATION . . . is the title of an attractive periodical available from M. W. Kellogg Co. The material describes in general terms the objectives of automation and dis-

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3	20	37	54	71	88	105	122	139	156	173	190	207	224	241	258	275	292	309	326
4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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4	21	38	55	72	89	106	123	140	157	174	191	208	225	242	259	276	293	310	327
5	22	39	56	73	90	107	124	141	158	175	192	209	226	243	260	277	294	311	328
6	23	40	57	74	91	108	125	142	159	176	193	210	227	244	261	278	295	312	329
7	24	41	58	75	92	109	126	143	160	177	194	211	228	245	262	279	296	313	330
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12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
13	30	47	64	81	98	115	132	149	166	183	200	217	234	251	268	285	302	319	336
14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

ANNOUNCING THE NEW LINE OF PALLEY HYDRAULIC CYLINDERS

CUSTOM BUILT AT MASS PRODUCTION PRICES

Our 10 years experience in filling the needs of Aircraft and Heavy Industry for Hydraulic Equipment have led us to the engineering and development of this all new line of Industrial Hydraulic Cylinders. Designed especially to meet the most rigid requirements of industry. All are double action with rugged steel construction throughout. Made to take pressures up to 1500 PSI and 3000 PSI. Utilizing standard 'O' rings with leather back-up rings on the 3000 PSI types. Have male clevis mounts on both ends.

We are also equipped to Custom Manufacture to your specifications. Write us Today for further details or expert advice on your problems.

PART NO.	BORE	STROKE	SHAFT	PSI	Type of CAP	THRUST	PRICE
PH34E	3"	4"	1-1/8"	1500	External Threaded	10,500 lbs.	$32.50
PH36E	3"	6"	1-1/8"	1500	" "	"	35.00
PHE1	3"	8"	1-1/8"	1500	" "	"	37.50
PH312E	3"	12"	1-1/8"	1500	" "	"	42.50
PH341	3"	4"	1-1/8"	1500	Inserted	"	32.50
PH381	3"	8"	1-1/8"	1500	"	"	35.00
PH45E	4"	5"	1-1/8"	1500	External Threaded	18,750 lbs.	37.50
PH46E	4"	6"	1-1/8"	1500	" "	"	39.50
PH48E	4"	8"	1-1/8"	1500	" "	"	43.50
PH410E	4"	10"	1-1/8"	1500	" "	"	47.50
PH412E	4"	12"	1-1/8"	1500	" "	"	51.50
PH45E3	4"	5"	1-1/2"	3000	" "	37,500 lbs.	52.50
PH46E3	4"	6"	1-1/2"	3000	" "	"	54.50
PH48E3	4"	8"	1-1/2"	3000	" "	"	58.50
PH410E3	4"	10"	1-1/2"	3000	" "	"	62.50
PH412E3	4"	12"	1-1/2"	3000	" "	"	66.50
PH518I	5"	18"	2"	3000	Inserted	59,250 lbs.	85.00
PH524I	5"	24"	2"	3000	"	"	107.50
PH530I	5"	30"	2"	3000	"	"	130.00
PH636E	6"	36"	2"	3000	External Threaded	86,625 lbs.	265.00

4-WAY, OPEN CENTER HYDRAULIC CONTROL VALVE

Has built-in adjustable relief valve, set at 1000 PSI with a spring loaded neutral position. Used for controlling (1) double action cylinder of the types shown in this advertisement. Can also be mounted in series. Has 3/4" standard pipe inlet & outlet ports. 1/2" pipe thread cylinder port. Shipping weight 10-1/2 pounds. . . . . **21.50 NEW**

NEW - HEAVY DUTY HYDRAULIC CYLINDER

A rugged, heavy duty cylinder. All steel construction. Double action. Has 7" bore. 13" stroke. 2½" steel shaft. Ideal for use in hydraulic presses, leveling ramps, hydraulic tail gates, industrial machinery, road machinery, etc. Shipping weight 180 pounds. . . **95.00**

GB-8-25 TON HYDRAULIC CYLINDER
Same as above except has 8" bore, 15" stroke. Will give 50000 lbs. thrust at 1000 PSI. Shipping weight 185 lbs. **105.00**

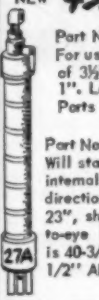
SAVE UP TO 85% ON GOV'T SURPLUS

SURPLUS HYD. CYLINDERS

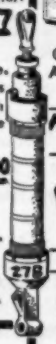
Special

Gov't Surplus Bargain. Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air system cylinder. Has a 4" bore, 18" stroke, 30½" length. Part No. 29. New & Used.

NEW **43.95** USED **29.95**



Part No. 27A. Finest Surplus. For use up to 1500 PSI. Has bore of 3½", stroke 21-5/8", shaft 1". Length 29⅛". Ports 3/8" AN pipe. **35.77**



Part No. 27B. Similar to above. Will stand up to 2000 PSI. Has internal stroke cushion in both directions. Bore 3-7/8", stroke 23", shaft 1-3/8", eye-to-eye length closed is 40-3/4". Ports are 1/2" AN pipe. **45.00**

Part No. 27C – Similar to 27A above. Take up to 1500 PSI. Has 3-1/2" bore, 23" stroke, 1-1/2" shaft, 34" closed lgth. 1/2" AN pipe ports. **45.00**

HYD. HAND PUMP

12.75

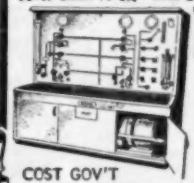
Top condition. Has operating pressure of 1500 PSI. Capacity of 1.5 cu. in. per complete cycle.

HYD. HOSE & TUBING

We stock a complete line of Hydraulic Tubing and Hose as well as all types of fittings and hardware. Send us your requirements.

TELESCOPING HYDRAULIC CYLINDER

Thrust shaft is in two stages. First stage extends 39" – the second stage extends 18". Each stage works seperately. The overall length eye-to-eye is 61½". Inner shaft is 2-3/4" dia. outer shaft is 3½" dia. Bore is 4¼". Ports are 1/2" AN pipe. **165.00**



COST GOV'T APPROX. $6000 **$1495**

AIR ASSOCIATES HYDRAULIC TEST STAND

Electric motor driven type. Has a 2500 PSI Hydreco Pump which delivers up to 10 GPM. Powered by 15 HP, 3 phase motor using 220/440 volt, 60 cycle current. Unit has selector valves, pressure gauges, flow meter, reservoir, heat exchanger and filter pressure regulator. Mounted on steel frame. Has work bench, flourescent lights and hand operated, high pressure pump for testing to very high pressures. Overall size: 8ft. long x 7ft. high x 4ft. deep.

HYD. TEST STAND – Same as above but has a Reeves variable speed reducer to control the pump output as desired. **$1895**

SURPLUS VICKERS PISTON TYPE-CONSTANT SPEED-HYD. PUMPS & MOTORS

Made to top Aircraft specifications. RPM shown below is the recommended maximum for constant speed. Quantities limited.

Part No.	Cu. in. per rev.	GPM	PSI	RPM	PRICES NEW	PRICES USED
HYDRAULIC PUMPS						
PF9-713-20BCE	.410	5.3	1000	3000	—	$20.00
PF9-2713-20ZE	.410	5.3	1500	3000	$24.50	—
PF9-2713-10Z	.208	2.7	1500	3000	$29.75	$22.50
PF2-713-25BCE	.507	6.5	1000	3000	$32.50	$22.50
PF50-3915-30YG	1.520	19.7	3000	3000	—	200.00
HYDRAULIC MOTORS						
MF9-713-15A	.310	4.46	1000	3750	—	$18.50
MF9-713-30BCF	.600	9.75	1000	3750	$37.50	—
MF9-713-25BCF	.507	8.25	1000	3750	—	$22.50

STRATO POWER HYDRAULIC PUMPS

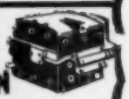
Designed and built to finest aircraft specifications.

PART NO.	GPM	PSI	RPM	PRICE EA.
SP-3	2	1400	3750	NEW $27.50
67WF300	3	1500	4500	USED 72.50
67WJ800	8	3000	4500	USED 87.50

NEW 10 TON HYDRAULIC PRESS

Here is a rugged 10 TON Arbor Press you can use in the shop or take with you on the job. Has sturdy frame of 4" welded channel iron. Press has 4-1/4" stroke, 2-1/2" diameter ram. A control valve operates the piston in both directions. Platform is adjustable. Has positive power Hand Pump. 2000 PSI pressure gauge. NEW **129.00**

NEW SURPLUS VICKERS HYDRAULIC TRANSMISSION

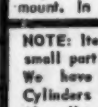


Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic pressure dash pot for smooth control. Power output RPM is 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator set-ups, Conveyors, Drives, etc. . . . **44.50**

4" SPLINE SHAFTS for input and power take-off on above. $2.50 pair

INPUT & TAKE-OFF PLATE ASSEM. To adapt trans. to pulley drive. Has high speed bearings and 1/2" keyway shaft. Per Set **20.00**

PESCO HYD. PUMP



A gear type pump. Will deliver 2 GPM at 1500 RPM with 1500 PSI – delivers 6 GPM at 4300 RPM with 1500 PSI. Has .375 cu. in. displacement per rev. Ports are 3/4" standard pipe. 5/8" male spline drive shaft. 4" pad mount. In good condition. **14.95**

Order from this Ad. Pay by Money Order or Check. P.O.s accepted from well rated D&B firms. 1/2 Dep. with C.O.D.s. Prices F.O.B.

Palley SUPPLY CO

2263 E. VERNON AVE., DEPT. AH-9 LOS ANGELES 58, CALIFORNIA

NOTE: Items shown here are only a small part of our tremendous stocks. We have over 100,000 Hydraulic Cylinders in 106 sizes and types. Also all type Valves, Pumps, Motors.

Useful Literature continued

cusses the basic elements of sensing equipment, recording equipment, controllers, and power operators. Typical systems such as gamma ray instruments, data reduction systems, electronic instrumentation, and high pressure instruments are described. Included is a discussion of high pressure flow measurement methods covering the use of an orifice plate, propeller-type instrument, sonic-type flowmeter, and others. Methods of measuring levels in high pressure systems are also discussed.

Circle 236 on Reader Service Card

STEEL STOCK . . . consisting of bars, structurals, plates, sheets, and strip are specified in Joseph T. Ryerson & Son, Inc. Bulletin 11-2. The new bulletin gives information on standard specifications to which these steels are made; type, range, and accuracy of cutting to user's needs; and opportunities to save money by combining orders for these products. Hot rolled carbon bar, structural, and flat rolled steels are featured in this bulletin.

Circle 237 on Reader Service Card

WATER FILTERS . . . with porous stainless steel filter elements are the subject of Release No. 214 from Micro Metallic Corp. Porous stainless steel filters have proved themselves in many critical industrial applications where corrosion resistance, high temperature, and high pressure are important factors. A complete description of standard sizes of water filters to handle 8 to 939 gpm is included. A typical flow sheet diagrams operation of the filters.

Circle 238 on Reader Service Card

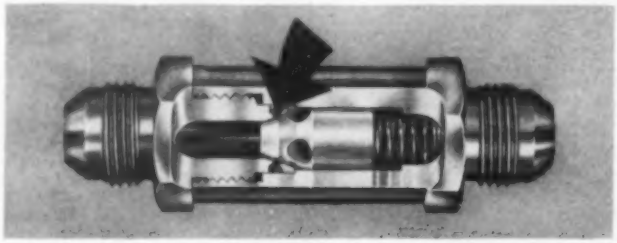
STEEL TUBING . . . Advantages, uses, and working data for its SAE hydraulic-quality, low-carbon steel tubing are set forth in Bulletin 39 just published by Superior Tube Co. The six-page folder shows, for the first time, a side-by-side comparison of four specifications which have been used for pressure applications. These are SAE, JIC, AMS 5050E, and ASTM-A-179. Specifications for the company's SAE hydraulic tubing are also given in the table. Other tables in the bulletin give recommended maximum working pressures and theoretical bursting pressures, minimum bend radii, standard tubing tolerances, and long-length limitations. A velocity-versus-flow chart furnishes data to determine the inner diameter of tubing for hydraulic systems.

Circle 239 on Reader Service Card

PRESSURE REDUCING VALVES . . . for maximum output pressures of 50, 100 and 150 psi on air, steam or water pressure are featured in Leaflet No. 13 offered by Williams & James (Engineers) Ltd. A description of the operation together with an internal view of the valve is presented. The valves are designed to give a minimum output pressure variation with variations of the input pressure, a maximum flow with a minimum pressure drop, and absence of leakage with no flow. The valve is balanced and is con-

The **FLEXIBLE SEAL SEAT***

Simple, Secure, Long-Lasting!



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC
CHECK VALVES

* PATENT APPLIED FOR

Circle 67 on Reader Service Card

"Wipe out" PACKING FAILURES WITH Seal-Guard METALLIC ROD WIPERS

Self-adjusting, easy to install, Seal-Guard's knife-like bronze rings "wipe off" all dirt and grime, will not mar the rod, are oil and heat resistant and friction-free.

HOW SEAL-GUARD WORKS

1. Twin wiper rings are mounted on rod with notches staggered.
2. Cushion ring is compressed on assembly exerting constant inward pressure keeping ring in constant contact with rod.
3. Harmful substances are completely cleared by scraper action.

Seal-Guards are available to fit rod diameters from ¼ to 24 inches. Other sizes by special order.

WRITE FOR DESCRIPTIVE LITERATURE.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

Circle 58 on Reader Service Card

trolled by a diaphragm and two springs, one of which is adjustable for altering the output pressure. The absence of glands ensures free operation of the valve without sticking or chattering.

Circle 240 on Reader Service Card

SOLENOID VALVES . . . with a plastic body which allows visual examination of the valve interior are included in Catalog No. 101 released by Valcor Engineering Corp. The straight-through flow principle of these valves allows 200 to 300% greater flow than other valves of identical size. Metering can be accomplished by shortening or lengthening the plunger stroke. Fine control is obtainable without critical hand motions, and settings are maintained indefinitely. Sealing is by a floating seal disc which outlasts conventional sealing methods and clogging of the valve is impossible because the shear action of the floating seal disc wipes the seat clean with every stroke.

Circle 241 on Reader Service Card

FLEXIBLE COUPLINGS . . . for connecting rotating shafts are the subject of Bulletin 53 published by Smith & Serrell, Inc. The bulletin provides complete data for proper specification of the coupling size for a range of motor drives from ½ hp at 600 rpm to 250 hp at 3600 rpm. Additional useful information is a coverage of the manufacturer's usual boring and key-seating practice which is helpful in determining the correct specifications and machining services of the manufacturer. These all-metal couplings are almost as simple as a rigid coupling. Dimensional drawings and a table show characteristics of the twenty-one sizes available.

Circle 242 on Reader Service Card

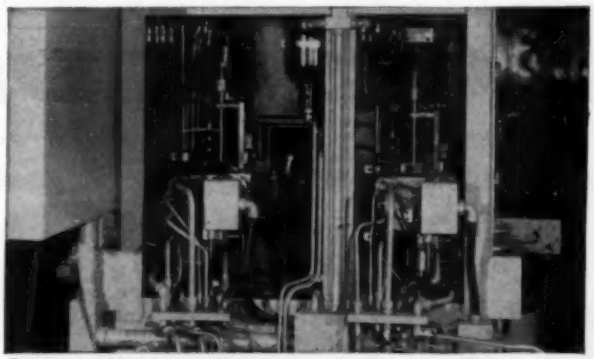
SOLENOID VALVE . . . for large volumes of water is described in Folder No. 210 from Hays Manufacturing Co. The folder describes the valve action which has pilot operation permitting maximum flow volume through a full port area. The valve is designed so that line pressure is permitted to do most of the work in operating the valve. Specifications are given for the series suitable for water pressures up to 150 psi and for the series suitable for air up to 100 psi. A graph indicates the pressure drop of water at varying flow rates for different size valves.

Circle 243 on Reader Service Card

PORTABLE AIR COMPRESSOR . . . for many on-the-spot applications with air tools is featured in a booklet published by Ingersoll-Rand. The booklet illustrates numerous applications of the compact portable unit which fits in a space 27 x 27 inches and is only 32 inches high. The unit weighs only 265 lbs. and is air cooled to operate under extreme weather conditions with no danger of freezing or overheating. Features of the compressor emphasized in the booklet are the oil bath air filter which serves both the air and power cylinders, the large capacity fuel tank which permits from 2 to 2½ hours operation without refill, and a vertical inductor-type magneto.

Circle 244 on Reader Service Card

DUAL VANE PUMPS . . . manufactured by Dudco Div. The New York Air Brake Co. are reviewed in Bulletin No. DP-302 offered by the company. The bulletin includes an illustrated explanation of the features of dual-vane principle and gives outline dimensions and performance data of the pumps. The dual-vane pump has two individual, hydraulically balanced vanes in each slot. The precision ground, cham-



Rear view of Micromatic Hydrohoner, showing piping. This machine, a combination of two double-spindle honers, automatically finishes 500 automotive connecting rods an hour to a tolerance of a few tenths of a thousandth.

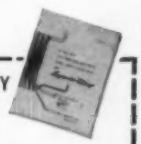
Easy-to-Form "SUPERIOR" Hydraulic Tubing Resists Vibration and Pressure Surges in Microhoning Production Equipment

Material used: SUPERIOR carbon steel hydraulic tubing, ½" OD x .049" wall and 5/16" OD x .035" wall.

Problem solved: The problem, the makers say, is threefold: ease of forming, ease of assembly, and ability to resist vibration and pressure surges of 100 to 500 psi without leakage. SUPERIOR tubing is the only tubing they have found that fills the bill. The non-aging hydraulic quality permitted the customer to keep an adequate supply on hand.

The process: Bores .006 in. to 40 ft. in length are regularly honed with Micromatic equipment. The Microhoning process is a method of automatically and rapidly removing stock from cylindrical surfaces. Microhoning produces geometrically straight and round holes, with uniform surface finish, and without generating localized heat.

Perhaps SUPERIOR can solve your problem, too. Use the coupon for free samples and literature. On the West Coast, write Pacific Tube Co., 5710 Smithway St., Los Angeles 22, Calif.



SUPERIOR TUBE COMPANY
2030 Germantown Ave.
Norristown, Pa.

☐ Send me a free copy of Bulletin 40—A Guide to the Selection and Application of Superior Tubing.

☐ Send me a free sample of.....(name of alloy) tubing;....." OD;....." wall; to be used for.....

Name.....

Title.....

Company.....

Street.....

City.....Zone.....State.....

Useful Literature continued

fered edges of the vanes create channels which enable fluid to pass from the vane slots to the tops of the vanes, so that equalized hydraulic pressure is maintained on all edges of the vanes. The pumps have capacities of 3, 5, 8, and 11 gpm at 1200 rpm and can be operated continuously at pressures to 2000 psi. They can be supplied for either flange or foot mounting.

Circle 245 on Reader Service Card

BALL BEARING PILLOW BLOCKS . . . and flange cartridge mounts are completely described in 52-page Bulletin A-638 published by Dodge Manfacturing Corp. Tabular data in the bulletin includes engineering drawings, dimensions, shaft sizes, weights, radial load ratings, and list prices. Throughout the book are product illustrations, including cutaway views showing inner construction. Seals used in these bearings are synthetic rubber with metal backing and are anchored mechanically so that they cannot blow under grease gun pressure. The bulletin also includes illustrations and data relating to plain units, flange and hanger bearings, and take-ups.

Circle 246 on Reader Service Card

SOLENOID VALVES . . . of the 2-way type are specified in Form No. V5001 issued by Automatic Switch Co. The material includes charts showing pressure drop for various flow rates of water, oil, and air; and indicates NEMA locations for which the valves are approved. In addition to being approved for operation in atmospheres containing flammable gases or vapors, the valves are also approved for atmospheres containing combustible dust, including metal dust. Pressure ratings for normally-open valves are now up to 250 psi on air, and new port and pipe sizes up to ¼ inch provide greater flow capacity.

Circle 247 on Reader Service Card

FUEL BOOSTER PUMP . . . Lear, Inc. Lear-Romec Div. has released Product Data Sheet No. 3-51 describing a submerged fuel booster pump which has a standpipe for operation during inverted flight. A weighted valve causes fuel to enter the pump through the extreme end of the stand pipe under this condition. The rated capacity is 3000 pounds per hour at a minimum pressure of 16 psi. The ambient pressure range is −67°F to 160°F; altitude 35,000 ft. The motor is .25 hp at 7200 rpm, and the weight is 6.5 lb. The pump operates in JP-4 fuel.

Circle 248 on Reader Service Card

OIL FILTERS . . . Houdaille-Hershey of Indiana, Inc. has recently released Equipment Bulletins 201, and 301 covering two types of their oil filters. Bulletin 201 describes multi-cartridge filters. Use of these filters for hydraulic systems eliminates much maintenance due to damage caused by oxidation products and solid abrasive particles suspended in the oil. The bulk refill oil filters described in Bulletin 301 operate on a bypass or recirculation basis with hydraulic oils. The depth-type filter is for oil viscosities up to 500 SUS at 100°F. The unit has center-tube construction with baffles to prevent channeling of oil along the center tube.

Circle 249 on Reader Service Card

ACCEPTED...

The accepted standard in protective metal closures for aircraft hydraulic lines and components originated with Tubing Seal Cap, Inc., over fourteen years ago.

SEND TODAY for new 1955 ILLUSTRATED CATALOGUE and PRICE LIST

TUBING SEAL CAP, INC.
808 WEST SANTA ANITA
SAN GABRIEL, CALIFORNIA
EASTERN OFFICE
428 NEW CENTER BLDG.
DETROIT 2, MICHIGAN

Circle 131 on Reader Service Card

SOLENOID VALVES... are covered in a catalog recently published by Magnatrol Valve Corp. The valves designed for service with water, oil, gas and other fluids are specified with numerous performance charts. A special section of the catalog is devoted to comparative tables of fluid discharge and friction drop. The coils in these valves are of the moisture-resistant type and will not short out when used in damp or wet locations. All solenoids feature a self-contained, terminal box with ½-in tapped conduit connection which may be turned in various directions for convenient wiring. The valves are designed for pressures up to 300 psi.

Circle 250 on Reader Service Card

AIR-LINE LUBRICATORS . . . are discussed in a new bulletin of Ingersoll-Rand. The lubricators described are made in sizes for use with the smallest hand-held air tools to the largest quarry-type drills. The bulletin illustrates damage to various parts of drills because of improper lubrication which is estimated to cause over 50% of air-tool failures. The new air-line lubricator in ½ and 1-pint sizes is shown in a cut-away illustration which shows the simplicity of construction, elimination of moving parts and foolproof metering device of the unit. The lubricator operates equally as well on constant or pulsating air pressure and functions efficiently in any position. Automatic pressure equalization prevents loss of lubricant when pressure is suddenly reduced or shut-off.

Circle 251 on Reader Service Card

VALVES . . . included in a wide range of products manufactured by A. W. Cash Co. are reviewed in their Bulletin No. S-730 just released. The bulletin contains photographs of 27 items in the company's line. Included is a streamlined reducing valve which incorporates three principles of design to ensure high capacity and close pressure control. These are a streamlined inner valve which eliminates turbulence, straight-line flow through the valve housing, and an aspirating effect which controls valve opening by amplifying slight pressure into large valve operating forces.

Circle 252 on Reader Service Card

GEARS . . . Sier-Bath Gear & Pump Co., Inc. has published a 44-page booklet covering various phases of gear design, manufacture, and application. The attractive booklet illustrates the principal types of gears and combinations showing the most modern methods and techniques of gear testing for extreme accuracies. Numerous engineering graphs and tables, embodies in a Gear Design Formula, are a valuable reference for design engineers. Subjects covered in the booklet include: cause of early tooth failure, simple physics of gear movement, shock loads, use of smaller gears for given loads, comparative action of gears having the same pitch diameter, load errors costly to gear life, how incorrect teeth multiply gear loads, and many others.

Circle 253 on Reader Service Card

STRAINER . . . for straight-line installation in the supply line is presented in Folder No. 240 issued by Hays Manufacturing Co. The strainer which is recommended for use with water, air, oil, steam, and gas has union couplings on both ends to make it a simple matter to install and to disassemble for clean-

Circle 254 on Reader Service Card

HIGH PRESSURE PUMP

air driven... *for pressures to 30,000 psi*

Use for hydraulic presses and other hydraulic machines for clamping, riveting, crimping, shearing and punching. Applicable also for hydrostatic testing and other high-pressure, low-volume service.

• Boost 100 PSI. air pressure to 10,000 PSI. fluid pressure for $173.25 (FOB Gardena, Calif.). Eight standard models as listed in table. Special models for lower or higher pressures. Applicable wherever low-volume output at high pressures is the requirement. For oil or water service. Complete power packages also available. Send for bulletins.

Model No.	Maximum Input Air Pressure	Nominal Ratio	Discharge Pressure at 100 PSI. Input Air Pressure	Prices, F.O.B. Gardena, Calif.
S-216-C- 10	150 PSI	10:1	1,100 PSI	$220.00
S-216-C- 20	150 PSI	20:1	2,100 PSI	210.00
S-216-C- 35	150 PSI	35:1	4,600 PSI	173.25
S-216-C- 60	150 PSI	60:1	6,600 PSI	173.25
S-216-C-100	150 PSI	100:1	8,800 PSI	173.25
S-216-C-150	150 PSI	150:1	15,200 PSI	194.50
S-216-C-200	150 PSI	200:1	23,750 PSI	225.00
S-216-C-300	100 PSI	300:1	33,500 PSI	289.50

SPRAGUE *Engineering Corporation*

1144 WEST 135TH STREET, GARDENA, CALIFORNIA

Circle 121 on Reader Service Card

Problem Clinic

Many fluid powered machines require an adjustable dwell at both ends of the piston travel. Simple automatic control can be provided by . . .

TWO LIMIT SWITCH ACTUATED TIMERS . . . to give regulated dwell

• By M. G. Saake

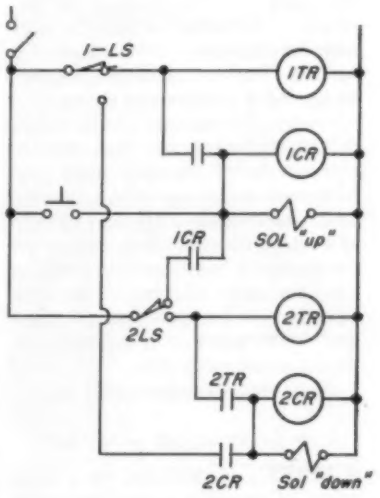
TWO motor timers with adjustable ranges of 0 to 5 minutes are used in this circuit. One is set to control the dwell when the piston is down and work is being performed. The second timer provides the dwell at the top of the stroke when work is being loaded.

With the line switch closed, the machine cycles automatically. The circuit drawing shows the position of the limit switches when the machine is down. Limit switch 1LS will transfer as soon as the machine starts upward movement. Limit switch 2LS will transfer when the machine is fully up.

The push button is a safety and convenience feature which immediately starts the upward stroke when pressed.

When the machine bottoms, timer 1TR is energized to initiate the bottom time cycle. After the time delay, contacts 1TR close to energize relay 1CR and the up solenoid in the directional control valve. Relay contact 1CR closes to hold the circuit. This contact is needed because, as soon as upward travel starts, 1LS opens to deenergize the timer and cause 1TR to open.

When upward travel is completed 2LS is tripped to deenergize relay 1CR and the up solenoid, and energize timer 2TR. Energizing 2TR starts the timer motor. After the elapsed timing period, contacts



2TR close to energize relay 2CR and the down solenoid of the directional valve. Contact 2CR locks the circuit during the down stroke to hold the down solenoid energized. Limit switch 2LS trips back to the position shown as soon as the machine starts down. This deenergizes timer 2TR. At the bottom of the stroke 1LS trips back to the position shown to deenergize the down solenoid and energize timer 1TR.

This cycle will automatically repeat as long as the line switch is closed. By using adjustable motor timers, the dwell is easily set on a clock face. ▼▼▼

for SUPERIOR DESIGN

use... Hydro-Line CYLINDERS

SERIES "J" CYLINDERS

for rugged, trouble free service

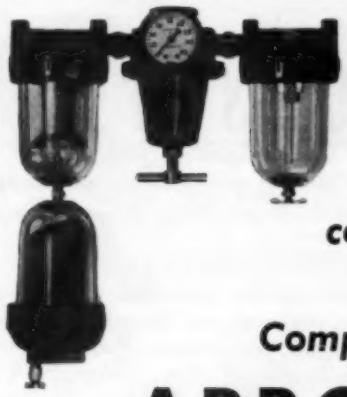
- *CARTRIDGE . . . rod-wiper, packing, bushing in one unit.*
- *RUGGED BODY . . . all steel end caps and barrel.*
- *PISTON RINGS . . . step-cut joint, sealing in both directions, long life, minimum leakage.*
- *PRESSURE . . . 2,000 psi heavy-duty . . . 3,000 psi non-shock.*
- *SIMPLICITY . . . no tie-rods . . . no retainer rings.*

Write for Bulletin No. 53

Hydro-Line Manufacturing Co.

5605 PIKE ROAD • ROCKFORD, ILLINOIS

Circle 9 on Reader Service Card



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for control and conditioning of Compressed Air

ARROW

Autopneumatic Control Assembly or Individual Units

Filters—Lubricators—Regulators—Water Traps
Will reduce maintenance, repair and down time to the minimum for all Air Power Tools and Appliances.

- Pipe Line Sizes: ¼", ⅜", ½", ¾", 1" and large capacity.

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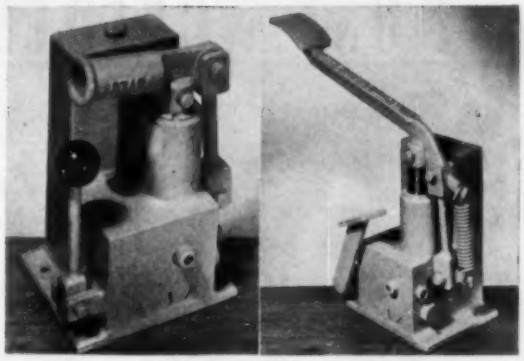
Circle 124 on Reader Service Card

STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS



- **HAND OR FOOT OPERATED WITH SINGLE LEVER OR PEDAL**
  Two speed construction provides automatic change-over during operating cycle from high speed low pressure to low speed high pressure.
- **MAXIMUM CAPACITY 10,000 P.S.I.**
  Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—5 models: (½"-⅜"), (½"-1¼"), (½"-1½"), (⅝"-1½"), (½"-2¼").

Representative areas available

Star Jack Co., Inc.

420 Lexington Ave., New York 17
PLANT: RIVER GROVE, ILLINOIS

it's IMPORTANT!

IF YOU USE

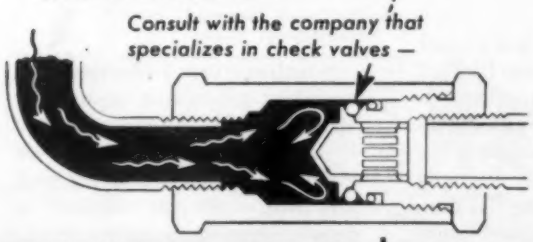
CHECK VALVES

Unseen Leakage Costs Money!

CIRCLE SEAL

precision check valves are engineered to give leak-free performance and trouble-free operation. CIRCLE SEAL quality is your INSURANCE against shut-downs or customer dissatisfaction.

Consult with the company that specializes in check valves —



JAMES-POND-CLARK

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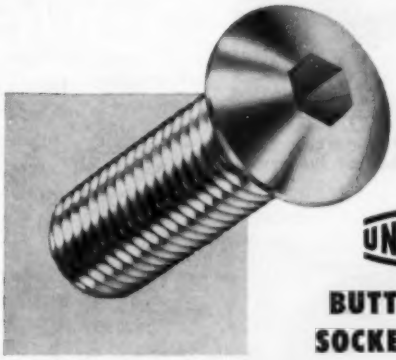
Engineering data sent free of charge on request.

Circle 64 on Reader Service Card

save with standard



UNBRAKO

BUTTON HEAD SOCKET SCREWS

BUTTON HEAD FEATURES

designed for applications where countersinking is not practicable

heat treated alloy steel for strength

low head height for streamlining designs

accurate hex sockets for nonslip drive and freedom from marred heads or mutilated work

fully formed threads—Class 3 fit

Save time and money by using standard UNBRAKO Button Head Socket Screws. Stocked in standard sizes—#8 through ⅝"—by your authorized UNBRAKO industrial distributor. Ask him for Bulletin 856. Or write STANDARD PRESSED STEEL Co., Jenkintown 2, Pa.

UNBRAKO SOCKET SCREW DIVISION **SPS**

JENKINTOWN PENNSYLVANIA

Circle 123 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Mel E. Maurer
Flex-O-Tube Division

J. L. Montmarquet
Houdaille-Hershey of Indiana, Inc.

George H. Garraway
The New York Air Brake Company

Mel E. Maurer has been named president of the **Flex-O-Tube Division of Meridan Corporation.** Until recently he has been operating vice president of Nesco, Inc., and was previously a production executive with Lockheed Aircraft and Hotpoint. Maurer succeeds Thomas A. Harwood, who continues as vice president and director of Meridan Corporation.

J. L. Montmarquet has become export manager of **Houdaille-Hershey of Indiana, Inc.** He will handle all export sales in all foreign countries including Canada. Montmarquet's headquarters are in Ridgefield, New Jersey.

The New York Air Brake Company announced the appointment of **George H. Garraway** to the position of director of manufacturing. With the company since June 1954, Garraway was previously vice president of Orr & Sembower. In his new capacity he will be responsible for organization, policy, procedures and planning for all manufacturing conducted by the company and its divisions.

Dow Corning Corporation announced that **Guy E. McFarland** will provide technical service on silicones in the Pacific Northwest territory.

Fred W. Bommer was elected chairman of the board and Richard B. Young, was elected president of the **Acushnet Process Company.** Bommer is president of the Acushnet Sales Company, a wholly owned subsidiary. Young has been associated with Acushnet since 1938 and held various positions in the engineering, manufacturing and sales departments of the Rubber Division.

Greer Hydraulics, Inc., have moved their Detroit offices to new and larger quarters at 21329 Woodward Avenue J. **Edgar Myles,** resident sales engineer and his staff will be available to assist their customers, and warehouse facilities have been obtained to stock a complete line of accumulators for faster service.

The Bristol Company has promoted **Ernest Nuber** to general field sales manager. With the Bristol sales engineering force since 1929, Nuber served as Pacific Coast manager, export manager and application engineering department manager.

Plastic and Rubber Products Company has appointed **Vernon J. Pease** as district manager for the Ohio district.

The Cushman Chuck Company has appointed the **Pearce-Dengel Tool Company,** Hasbrouck Heights, New Jersey, as their representative in northern New Jersey, Metropolitan New York and as far north as Poughkeepsie.

Southwestern Industries has tripled its production capacity by moving to a newly completed plant in Los Angeles. Augumented engineering and manufacturing facilities will enable the company to double its sales.

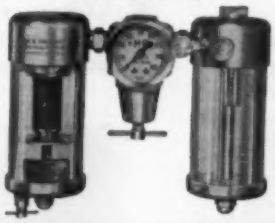
Circle 79 on Reader Service Card

3 in 1 GUARD of the AIR LINE

M-B

WHIRL-A-WAY
FILTER-REGULATOR
and
LUBRICATOR ASSEMBLY
MODEL W-3

the BEST PROTECTION TO YOUR AIR-VALVES, CYLINDERS, PNEUMATIC TOOLS, ETC.



The FILTER removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR capable of passing large volume with unrestricted flow and minimum pressure drop. LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

ANY OF THESE 3 DEVICES CAN BE USED AS SEPARATE UNITS OR IN ANY COMBINATION

WRITE FOR LITERATURE

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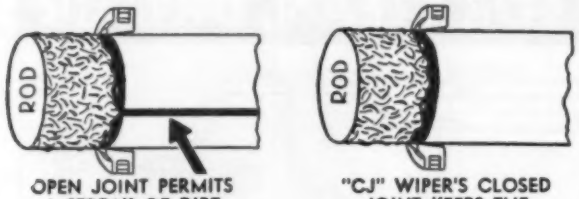
This or This?



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

For those dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint
(our P/N-FWR-CJ)

In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use the 3 Piece FALL WIPER RING FWR-3C**

Spec. Mil-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) an endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

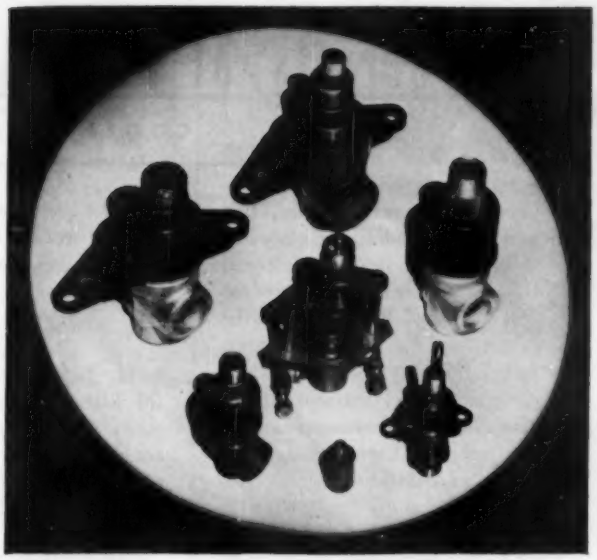
—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Co., Toledo 1, Ohio
Phone Cherry 36513

Fall Wiper Ring SPRING LOADED

Covered by patents issued and patents pending.



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AUTOMATION SPOTLITE

ROTHERM JOINTS

have recently mechanized the handling of hot castings in the foundry of a leading automotive manufacturer.

ROTHERM JOINTS

completely eliminated maintenance cost for 4 years on 17-ton calender rolls in the plastic industry.

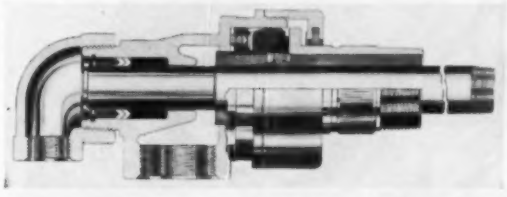
ROTHERM JOINTS

handle ethylene glycol without leakage on food processing dryer rolls.

ROTHERM JOINTS

can be used on steam, air, hydraulic and vacuum installations.

Typical Rotherm Joint applications: Bottle filling machines • Calenders • Mills • Paper and Textile Dryers • Rotary Assembly Benches • Air and Hydraulic Cylinders • Paint Spray Equipment • Gun Drilling • Air and Hydraulic Clutches.



Rotherm Double Rotation Unit

Also available in single, triple and quadruple rotation.

Sizes ¼" to 5"—inclusive

Rotherm Engineering Company

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Post Scripts of Industry

continued

Greer Hydraulics, Inc., has moved to new and larger offices at 6736 Lankershim Boulevard, North Hollywood, California. The new expansion, with **Ernest O. Gibson, Jr.,** as operations manager, is fully staffed to handle design, engineering, sales, distribution and service. **Daniel Hayes** will assist in the test equipment section and **Zachary LeBolt** in industrial products. The acquisition of warehouse facilities makes available to West Coast customers a complete selection of test equipment, spare parts and accessories.

Otmar E. Teichman has been named manager of the heat-power research department at the **Armour Research Foundation of Illinois Institute of Technology.** He joined the Foundation in 1942 as research engineer, was named supervisor of the fluid mechanics section of the heat-power research department in 1945 and became associate manager in 1953.

M. J. Lester, district manager for **The Garlock Packing Company** in Denver, will retire after concluding fifty years with the company.

Richard B. Johnson has been named a production engineer by **Superior Tube Company** in Norristown, Pa. A graduate from Clarkson College of Technology, Johnson was formerly associated with the Aluminum Company of America.

Metal Goods Corp., Wichita, Kansas, has been appointed as a distributor for tube fittings and tube-working tools manufactured by **Parker Appliance Company. Carl Brown** is manager of this recently established distributor.

E. A. Pierce, chairman of the board of directors of **Vickers Incorporated** announced the election of three new officers. **Harry F. Vickers,** vice chairman of the board; **Kenneth R. Herman,** president; and **Dr. N. E. Edelf-**

Harry F. Vickers
Vickers Incorporated

CLAMP YOUR WORK HYDRAULICALLY!

This folder shows how to SLASH ASSEMBLY TIMES

Simple • Inexpensive Instantaneous for

MILLING • GRINDING
WELDING • GLUEING
and every Clamping Problem

A NEWTON PRODUCT

POWER JACKS LIMITED
VALETTA RD. · ACTON · LONDON · W.3

1960

Circle 103 on Reader Service Card

FOR CLEAN, DRY AIR

Distributing Line Of Cool Air From Receiver Tank
Vapor Free Air Near Point Of Use
Take Off From Top Of Pipe
Replaceable Desiccant

MURPHY TRIUMPH AA SEPARATOR-FILTER
Sizes: ¼, ⅜, ½, ¾;
Weight 30 lbs; Pressures: 0 to 125 psi;
Price: $71.00 ea; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities.

Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

AFTERCOOLERS FOR 10 CFM TO 10,000 CFM—SEPARATORS—TRAPS

JAS. A. MURPHY & CO. INC.
Hamilton, Ohio

Circle 90 on Reader Service Card

sen, vice president for engineering. Vickers, who is founder of the company, is also president of Sperry-Rand Corporation of which Vickers is a subsidiary. Herman, formerly vice president and general manager joined Vickers in 1931 after a diversified engineering career. He is a vice president of Sperry-Rand Corporation and was recently named a member of its board of directors. A graduate of Utah State College and the University of California, Dr. Edelfsen has broad experience in the field of electronic and control system research. Prior to joining Vickers he was with North American Aviation, Inc., as director of the electromechanical engineering department of the missile and control operation.

J. Austin Boulay has assumed the duties as comptroller for Minnesota Rubber and Gasket Company, and will supervise the costs and accounting sections of the firm.

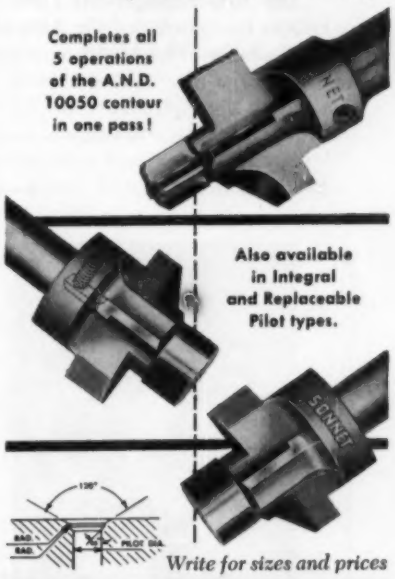
Kenneth R. Herman
Vickers Incorporated

Dr. N. E. Edelfsen
Vickers Incorporated

Circle 119 on Reader Service Card

Sonnet A.N.D. 10050 Port Contour Cutter

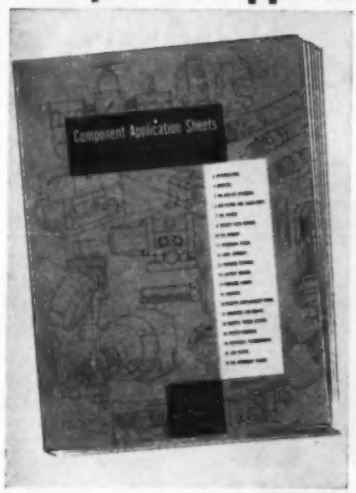
now available in a NEW Replaceable Reamer Type


Completes all 5 operations of the A.N.D. 10050 contour in one pass!
Also available in Integral and Replaceable Pilot types.
SONNET

Write for sizes and prices

SONNET TOOL and MFG. CO.
571 No. Prairie Avenue • Hawthorne, California

Component Application Sheets



This 32 page booklet describes air and oil components.

It tells:

- where they're used
- size range
- how they operate
- construction

Provides an excellent training aid.

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Please send me.....copy(ies) of "Component Application Sheets" at 50 cents each. Check is enclosed.

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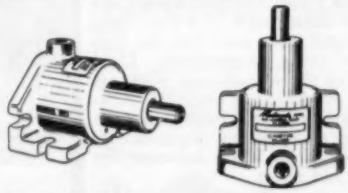
Modernair

CLAMP-TYPE AIR CYLINDERS

Easiest to install or relocate!



UNIVERSAL MOUNTING for easy vertical or horizontal installation.
SLOTTED MOUNTING HOLES save installation, relocation time.
SPRING-RETURN TYPE CYLINDER operates from simple 3-way valve (MODERNAIR CRV or BV series recommended). Has ⅛" NPT port.

ECONOMICALLY PRICED, TOO!

Bore Size	Price (f.o.b. factory) 1" Stroke	2" Stroke
1⅛"	$ 8.50	$ 9.75
2"	16.00	19.00
3"	23.50	26.50

Write TODAY for Free Literature!

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Member National Fluid Power Association 9

Post Scripts of Industry
continued

The **Aro Equipment Corporation** has purchased the **Ampatco Laboratories Corporation.** Ampatco which will operate as a separate corporation in Aro's Cleveland plant, will conduct basic research, development and manufacturing in the field of electro-mechanical devices. **Albert Patin,** present head and founder of Ampatco will remain with the company and retain some stock interests.

Albert Patin
Ampatco Laboratories Corp.

Promotion of **Frank D. Skelley** to the position of contract liaison manager of **Houdaille-Hershey of Indiana, Inc.,** has been announced. He was previously the company's New York area representative and will now handle government contracts and special assignments.

Frank D. Skelley
Houdaille-Hershey of Indiana, Inc.

The Industrial Actuators and Controls Division of **National Pneumatic Co.,** Boston, have appointed **The Grapek Co.,** 153 Frelinghuysen Ave., Newark, N. J. as a distributor for the northern New Jersey area.

The Air Flow Equipment Co., 1626 Grange Street, Philadelphia 41, Pa., has also been appointed as distributor for the Philadelphia and southern New Jersey area.

Electro Dynamic Division of General Dynamics Corporation has appointed **William L. Pharmer** as assistant sales manager. A graduate of Tri-State College, Pharmer has been engaged in the application and sale of elec-

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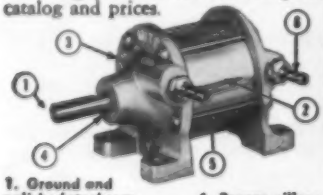

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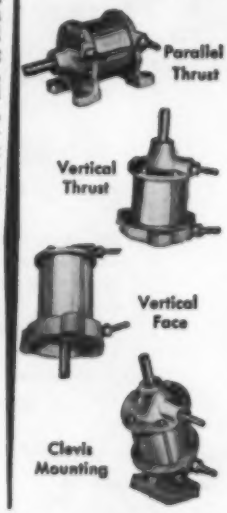

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William L. Pharmer
Electro Dynamic Division
General Dynamics Corp.

trical rotating equipment for the past fifteen years.

A. K. Brill has retired from his position as development manager at the **Republic Rubber Division,** Lee Rubber & Tire Corporation. **J. P. Mathews** has been promoted to chief chemist and has assumed the duties formerly handled by Mr. Brill. Mr. Brill had been development manager since 1930. Mr. Mathews joined Republic as a chemist in 1926.

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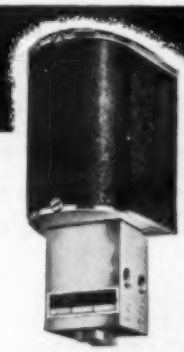

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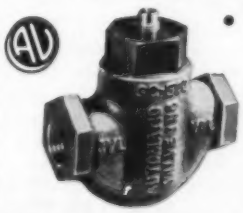

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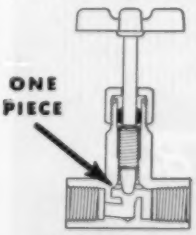

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ADVERTISERS' INDEX

September 1955

A

Ace Products 149
R. P. Adams Co., Inc. 113
Adel Precision Products Div.
General Metals Corp. 4
Air-Mite Devices, Inc. 152
American Cast Iron Pipe Co. 14
American Crucible Products Co. 10
American Hollow Boring Co. 128
Anchor Coupling Co., Inc. 46
Arrow Tools, Inc. 147
Automatic Valve Co. 153

B

Barksdale Valves 156
Bellofram Corp. 61
Bellows Co. 91
Bendix Aviation Corp.
Pacific Division 109
Bendix-Skinner Division
Bendix Aviation Corp. 154
Benton Harbor Engineering Works, Inc. 130

C

Capital Engineering & Mfg. Corp. 140
Century Hydraulics 110
Chamberlain Industries, Ltd. 133
Chicago Rawhide Mfg. Co. 40, 41
Chiksan Co. 105
Clover Industries, Inc. 127
Commercial Shearing & Stamping Co. 83
The Cornelius Co. 140
Crane Packing Co. 25

D

Darling Valve & Mfg. Co. 131
Denison Engineering Co.
Subsidiary of American Brake Shoe Co. 58, 59
Detroit Coil Co. 45
Dowty Hydraulic Units Ltd. 132
Dudco Division
New York Air Brake Co. 6, 7

E

Eagle Signal Corp. 57
Eastern Industries, Inc. 66
Eastman Mfg. Co. 15
Electro-Dynamic Div.
General Dynamics Corp. 31
Emsco Manufacturing Co 123
James L. Entwistle Co. 42

F

Fawcett Preston & Co., Ltd.
Metal Industries Group 122
Flex-O-Tube
Div. of Meridan Corp. 52
S. G. Frantz Co., Inc. 96
Fulflo Specialties Co., Inc. 136

G

Galland Henning Mfg. Co. 112
Gar Precision Parts, Inc. 118
Garlock Packing Co. 32

Gast Mfg. Corp. 155
General Hose & Coupling Co. 119
Gerotor May Corp. 55
Goshen Rubber Co., Inc. 137
Greene, Tweed Co. 94
Gresen Mfg. Co. 152

H

Hanna Engineering Works 1
Hannifin Corp. 95
Hansen Mfg. Co. ..... Cover 2
Hilliard Corp. 62
Houdaille-Hershey of Indiana, Inc.
Filtration Division 134
E. F. Houghton & Co. 47
Howell Electric Motors Co. 117
C. B. Hunt & Son 19
Hydraulic Accessories Co. 142
Hydraulic Power Div.
Hydraulic Press Mfg. Co. 20
Hydreco Div.
New York Air Brake Co. 6, 7
Hydro-Line Mfg. Co. 146
Hydromotor Division
The Bonnot Co. 37

I

International Packings Corp. 12

J

James-Pond-Clark 147
Joy Manufacturing Co. 138

K

Keelavite Rotary Pumps & Motors, Ltd. 29
Kepner Products 142
Kewanee Ross Corp.
Ross Heater Division 93
Walter Kidde & Co., Inc. 103
Kraissl Co., Inc. 114

L

L & L Mfg. Co. 106
Ledeen Mfg. Co. 60
Lenz Co. 133
Lincoln Machine Co., Inc. 126
Linear, Inc. 43
Logansport Machine Works, Inc. 63
Loud Machine Works, Inc. 111

M

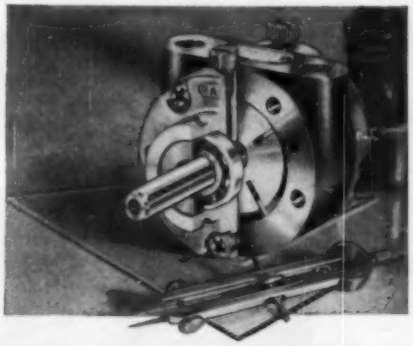
M-B Products 149
C. W. Marsh Corp. 115
Jas. P. Marsh Corp. 153
Marshalltown Mfg. Co. 107
Marvel Engineering Co. 17
Mayson Mfg. Co. 18
Mechanical Air Controls, Inc. 120, 121
Miller Fluid Power Co. 116
Minnesota Rubber & Gasket Co. 2
Modernair Corp. 151
Monsanto Chemical Co. 11
Jas. A. Murphy & Co. 150

N

National Motor Bearing Co., Inc. 28
National Pneumatic Co., Inc.
And Holtzer-Cabot Div. 135
New York Air Brake Co. 6, 7

Circle 44 on Reader Service Card

Rotary Air Motors
1/20 to 4 h.p.



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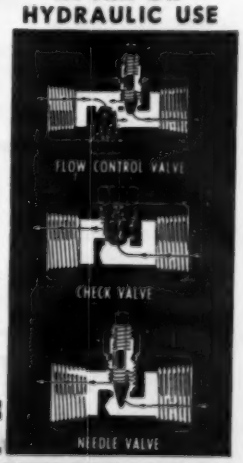

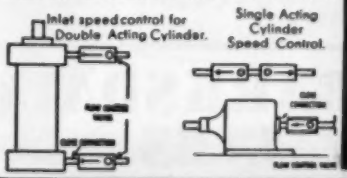

Pneu-Trol Devices, Inc.
1426 N. Keating Ave., Chicago 51, Ill.

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Its features in terms of application with the Servis Recorder

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PROOF PRESSURE TO 7000 PSI and actuation as low as 15 PSI.	Even though the minimum load setting may be relatively low, the surges due to jolts or bumps cannot upset the switch accuracy.
±2% REPEAT ACCURACY because of honed piston bore and direct switch action.	Accuracy is invaluable to the Servis Recorder and the Barksdale switch retains its repeat accuracy, even after long service, because there are no wearing parts to cause the settings to drift.
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If these features suggest a solution to your problem, please write for Bulletin 9612.

BARKSDALE VALVES

PRESSURE SWITCH DIVISION

5125 Alcoa Ave., Los Angeles 58, California

ADVERTISERS' INDEX

O

Oilgear Co. 13
Ortman-Miller Machine Co. 53

P

Page Belting Co. 50
Palley Supply Co. 141
Parker Appliance Co. 56, 106
Pathon Mfg. Co. 5
William S. Pine 127
Pneu-Trol Devices, Inc. 155
Power Jacks, Ltd. 150
Precision Rubber Products Corp. 9
Protective Closures, Inc. 100

R

Raybestos Manhattan, Inc.
Packing Division 21
Republic Mfg. Co. 101
Resistoflex Corp. 107
J. E. Rhoads & Sons. 54
George D. Roper Corp. 44
Rosaen Co. 127
Rotherm Engineering Co., Inc. 149

S

A. Schrader's Son
Div. of Scovill Mfg. Co. 51
Sealol Corp. 48
Simplex Engineering Co. 30
Snap-Tite, Inc. 64
Socony Mobile Oil Co., Inc. 85
Sonnet Supply Co. 151
Sprague Engineering Corp. 26, 145
Standard Oil Co. (Ind.) 27
Standard Pressed Steel Co. 147
Star Jack Company, Inc. 147
Stratoflex Co. 129
Summerill Tubing Div.
Columbia Steel & Shafting Co. 97
Sun Oil Co. 99
Superior Tube Co. 143

T

Texas Company 68
Tomkins-Johnson Co. 87
Tru-Flate, Inc. 101
Tubing Seal Cap, Inc. 144
Tuthill Pump Co. 38

U

U. S. Electrical Motors, Inc. 39
U. S. Gasket Co. 139

V

Valvair Corp. 23
Vickers, Inc. 33, 34, 35, 36
Vickers-Armstrongs, Ltd. 49

W

Waterman Engineering Co. ..... Cover 3
Webster Electric Co. 24
E. B. Wiggins Oil Tool Co., Inc. 107

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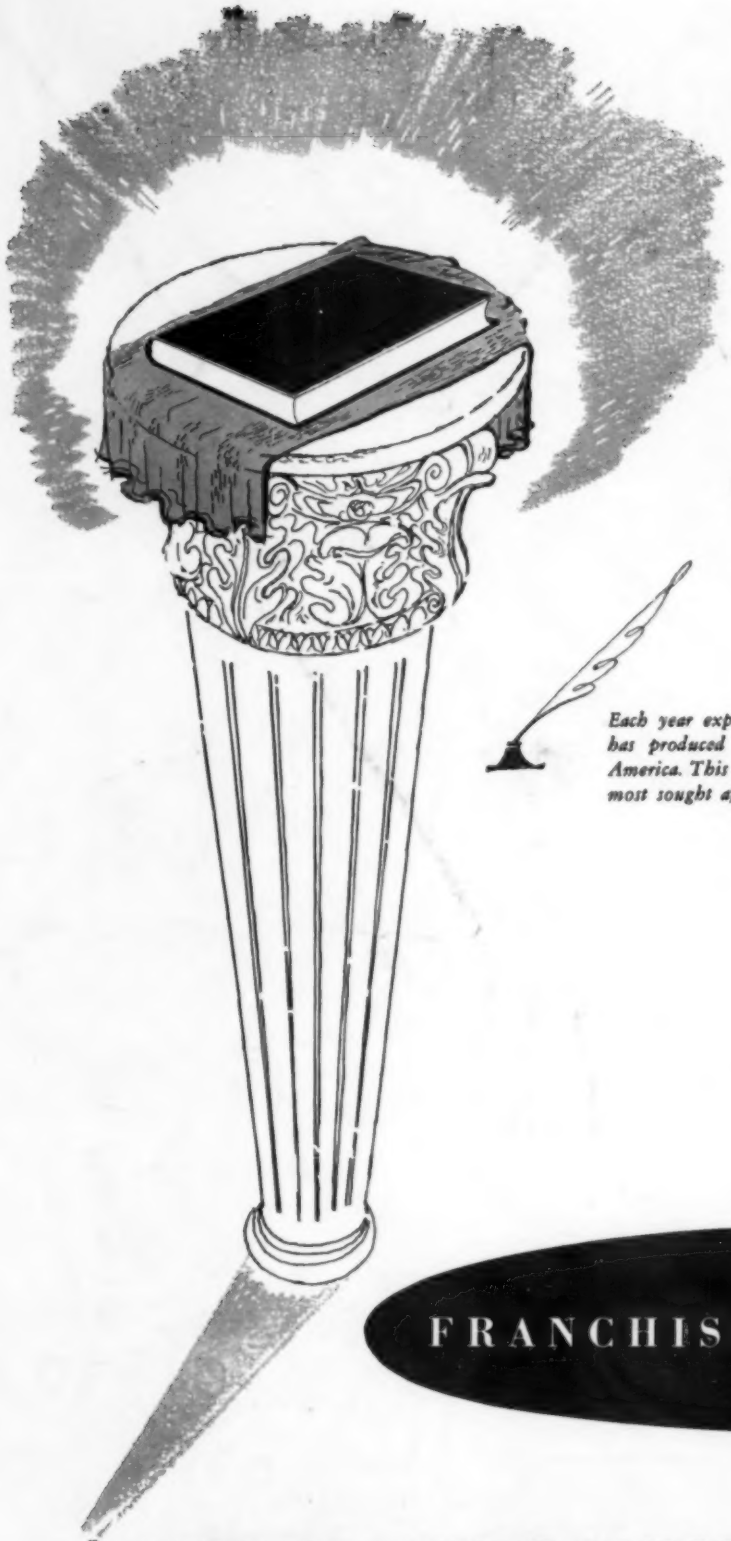

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